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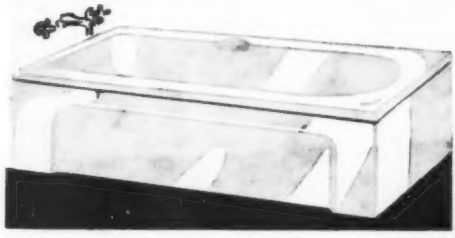
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metal finishing Journal

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J. D. GARDOM
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JOHN ADAM HOUSE
17-19 JOHN ADAM STREET
ADELPHI, LONDON, W.C.2
Telephone : TRAfalgar 6171 (P.B.X.)
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P AND COMING

ONE of the most important measures of the prosperity and progress of an industry is the ease or difficulty with which it attracts recruits. The considerations which influence the choice of a career by a boy leaving school are varied and in one or two cases apparently irrelevant. They are nevertheless very real ones and if an industry is to assure itself of an adequate supply of manpower at all levels, very careful thought must be given to making out a case which will give adequate weight to those factors which weigh most heavily when the choice of a career is being made. Many of these factors have been subjected to scrutiny by industrial psychologists and similar experts, and in many cases it has been shown that the emphasis lies in what might be considered to be an unexpected direction.

Matters on which the school leaver requires to be satisfied include, apart from such obvious things as remuneration and prospects of promotion, such ancillary considerations as the social prestige associated with the job, the cleanliness of the job, and the actual interest of the work involved. All these factors and several others must be presented in as favourable a way possible if an industry is to obtain for itself the correct recruitment of personnel in terms of both quantity and quality.

It should not really have needed a television panel game to bring home the fact that there are very many occupations combining high skill and remuneration, whose technical and industrial significance has remained largely obsure to the public at large. It is perhaps difficult to invest the art of being a "saggar-maker's bottom-knocker" with any real glamour in the public eye, but something of the sort has to be attempted if (in this case) the ceramic industry is to continue to prosper. This is the sort of difficulty with which the metal-finishing industry, and in particular the electroplating branch of it has been faced, and there have been encouraging signs of late that active steps are being taken to promote the industry from the point of view of attracting a greater influx of recruits. While the public at large, and school leavers in particular, will have been generally aware that articles are normally subjected to some sort of finishing process, there has been no real generalized conception of the large and important industry which has been built up to provide the finish.

It has been claimed that the modern age is a technical age and the new opportunities are being sought in such advanced technical fields as electronics, atomics, and the remoter recesses of organic chemistry. Metal finishing is fortunate in that it can profit from some of the reflected glory of these major industries. This was affectively pointed out by Dr. J. E. Garside, principal of the Borough Polytechnic on a recent occasion when the opportunity was taken to entertain a number of Headmasters and Careers Masters from leading London schools and to give them some insight into what the metal finishing industry comprises and what it has to offer as a career. Much of metal finishing today is applied science and behind the application of science must lie its theory and fundamentals, so that today the industry is one in which the application of pure science plays a large part. As a result there are now in the industry many excellent opportunities for young men to find careers which are both fully satisfying and amply remunerative. It is to be hoped that those Careers Masters took back from their meeting with Dr. Garside and members of the Institute of Metal Finishing Education Committee, and from their visit to the Metal Finishing Laboratories of the Borough Polytechnic, an impression that there is an industry that has something real to offer many of the boys they will shortly be handing on to the industrial world.

Talking Points

by "PLATELAYER"

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

POOR SHOW

EXPERTS on the subject of corrosion usually like to start off by saying that corrosion costs the country so many millions of pounds per annum, and what a dreadful waste it all is. In a recent survey on behalf of the Institution of Civil Engineers Dr. W. H. J. Vernon entered the lists and came to the conclusion that some £250 million per annum represented a reasonable estimate of the losses incurred in this country through the corrosion and deterioration of metals. To this should be added the sum of £350 million a year expended on preventive measures. From this he goes on to deduce that the cost of corrosion and prevention adds up to the "grand total" of something like £600 million per annum. Of course, this takes no account of indirect losses, such as contamination, plant break-downs and so on, that would arise if corrosion protection of all kinds were abandoned.

How important or valuable exercises of this kind are is a moot point, but the figure for the amount spent on corrosion prevention is indeed a striking one. If we accept Dr. Vernon's conclusions, it appears that it costs 11/6d. to prevent each £1 worth of metal from becoming a total loss each year. This is quite fantastically inefficient, and indeed one would be very hard put to find another field where the cost of preventive maintenance amounts to such a high proportion of the cost of doing nothing. Let us hope there is a fallacy in the calculations, because if there is not, then the methods of corrosion prevention in current use leave much to be desired. All that one could then say in their favour is that they are good for trade !

FALLING BETWEEN TWO TOOLS

ELECTRO-CHEMICAL methods of machining are making rather slow progress in this country but in the U.S.A. already several hundred installations are in operation and a considerable number of important machine tool manufacturers are now offering grinding equipment adapated for use with the electro-chemical process.

One of the most important methods makes use of metal bonded abrasive wheels operating in an electrolyte. The insulated wheel may be of diamond, cemented carbide or alumina, the work being made anodic so that the metal dissolves in the electrolyte when current is applied. In this way a rapid rate of metal removal to a high degree of accuracy is obtained. A great advantage of the process is complete freedom from heating so that metallurgical damage to high speed steels, for example, can be completely obviated. This is particularly important for some articles where large areas have to be machined at the same time. As an example, gas turbine blades are machined on a disc-type wheel and an average depth of 1/10th in. of material can be removed in 25 seconds. Die cavities can be sunk in the same way at very high speeds, current densities of up to 50 amp. per square inch of electrode area being readily employed.

The process will be rather slow in developing in this country because it falls between two industrial fields, and neither the electrodeposition nor the machine tool people feel quite at home in both of them.

PROGRESS IN VACUO

THE growing importance of vacuum coating as a finishing process is shown by the fact that in the U.S.A. a Society of Vacuum Coaters has been in existence for some time. This year the Society is holding a two-day conference at which seven papers will be presented on such subjects as the selection of oven equipment for vacuum coating, glow discharge cleaning and dip-dyeing finishes for vacuum metallizing.

There are now extensive applications of the process in this country, yet the number of technical papers and meetings devoted to it is all too small. If the Institute of Metal Finishing, for instance, were to organize a conference on the subject, the response might well be surprising.

Incidentally, the advent of a vacuum coater in "What's my line ?" would cause consternation on the panel !

BRIGHTER EGGS

THE ingenuity of firms seeking new markets for their products is often remarkable. A firm of small tool manufacturers is now supplying buffing wheel attachments and a special compound to farmers for the cleaning of eggs. It is claimed that eggs can be cleaned on the unit at the rate of 300 an hour.

Polishing eggs at this rate is likely to be a somewhat delicate, if not hazardous, process. The consequences of applying a slightly excessive mop pressure might make the scene of operations somewhat reminiscent of an early Mack Sennett comedy. But the customers would probably be even more pleased if it were possible to add freshness to brightness.

Technical Control in Electroplating

A one-day Symposium organized by the London Branch of THE INSTITUTE OF METAL FINISHING

On November 19 at the Charing Cross Hotel, London, a one-day Symposium on the theme "Technical Control in Electroplating" was organized by the London Branch of the Institute of Metal Finishing. The presence of well over 200 members and visitors and the fact that the discussion at each session had to be curtailed in order to adhere to the time schedule, afforded ample evidence of the popularity and value of this type of meeting. In this METAL FINISHING JOURNAL report the four papers have been abstracted, together with some items of more permanent interest from the discussion.

ABSTRACT

THE CHEMICAL CONTROL OF PLATING ELECTROLYTES

*K. E. Langford**

THE basic necessity for chemical control of plating electrolytes is to assist in the maintenance of desirable metallurgical properties in the deposited coating. In shop practice close chemical control helps to eliminate bad work and consequent breakdown of production flow through the department. Chemical control must be regarded as a preventative measure and not as a cure for troubles which need not have occurred.

The plating chemist should, in general, be able to deal with all necessary analyses and their interpretation, the making of recommendations as to additions to keep the solutions up to the pre-set standard, and the making of the required calculations, etc. when a new vat is installed or a new electrolyte made up. Other requirements may also be necessary but the plating chemist must possess technical ability of a high order, a fertile imagination, some knowledge of human or inhuman psychology coupled with a degree of scientific cynicism and a "thick skin."

Solution compositions should be checked according to their degree of stability or otherwise, and the system used should become "routine."

There is a distinct difference between analysis and control, and for control to be effective analytical results should be obtained with reasonable rapidity so that they can be related to current conditions and not to the composition of the bath sampled many days previously. Analyses carried out should be the minimum necessary to enable a solution to function satisfactorily. In addition, it is time-wasting to make very small daily additions to vats when a more substantial weekly make-up may be made equally quickly. Control should be carried out regularly and in such a way that the minimum of interference is given to shop personnel engaged on production work.

Sampling is easy in air-agitated solutions but still solutions must be thoroughly mixed before a sample is taken, and before deciding on the type of analytical method to employ it is advisable to consider the degree of accuracy expected in the results. There is frequently a wide choice of methods by which any particular bath constituent may be determined and economics may play a part. A method may employ an expensive reagent or require expensive apparatus yet may be justified by its speed.

Gravimetric methods are generally very accurate and reliable but involve filtration of precipitates, burning-off and drying, and are therefore time-consuming. Volumetric methods are less accurate, but yield consistent results and are often satisfactory for the plating chemist. With electrometric methods there is an interim period while electrolysis is taking place during which other work can be carried out. Physical methods need expensive apparatus, but results can be produced rapidly.

With the exception of sulphate in Cr. baths and certain metal-content determinations in alloy baths which involve separations, a complete scheme of analysis can be built up on volumetric procedures, most of which are rapid, reasonably accurate, and economical of materials.

In the realm of volumetric analysis the most interesting development is that of the chelatometric titration using ethylenediamine tetra-acetic acid; no less than 46 elements, it is claimed, can be titrated directly or indirectly using this versatile reagent.

In gravimetric analysis the most notable advances have been in balance design which have enabled more rapid weighings to be carried out. The

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most spectacular advances have been in the field of instrumentation.

As regards the future, there are instances where improvements in analytical techniques would be welcomed, the determination of sulphate in chromium baths being an example. The recently published B.N.F. method is an attempt to avoid gravimetric procedure, but the apparatus is elaborate and a cylinder of N_2 is required. There is also considerable scope for methods for the determination of brighteners and levellers in organic bright nickel and other solutions, and a series of spot reagents for metallic impurities would be invaluable. Semi-micro methods would be worth further experimental work, and another useful addition to knowledge would be more detailed information on the destruction of cyanides with acids with or without the addition of oxidizing agents.

DISCUSSION

MR. S. BAIER (British Non-Ferrous Metals Research Association) said that very little had been published in recent years concerning new developments in methods of analysing plating solutions. There was no real dearth of new methods and it was largely a matter of adapting known and published methods of analyses for application to plating solutions and having done this of getting plating chemists to co-operate in evaluating the methods. The suggestion was put forward by Mr. Langford that a technical panel should be formed to undertake such work and this was very much in line with what the B.N.F.M.R.A. was thinking; he expected that a panel of that nature would be coming into being very shortly.

MR. J. W. OSWALD (Fescol Ltd.) said that the main function of a plating chemist was to anticipate trouble and stop it before it occurred. A chemist could not achieve this by confining himself to his laboratory and analysing samples. It was important that he got out into the works and studied the plating shop in action and by keeping his eyes open he would get many clues as to potential sources of trouble.

MR. E. A. OLLARD (Atlas Plating Works Ltd.) called attention to the work of the B.S.I. in connexion with the specification of methods of test. In order to ensure that a process complied with a B.S.I. specification a test method had to be used which gave reliable quantitative results and these were very carefully worked out by panels of the B.S.I. and verified in the laboratories of members.

DR. H. E. ZENTLER GORDON (Modern Electrolytic Patents and Processes Ltd.) referred to Mr. Langford's comments that physical methods of analysis called for expensive equipment requiring skilled and elaborate calibration. He would like to make the point that many of these instruments, and he would refer in particular to the polarograph, were now available in cheaper and simpler versions. The cost of these instruments was of the order of £150 and they were capable of carrying out a solution analysis in two and a half minutes, using a semi-skilled laboratory hand without much supervision. Furthermore, comparatively unskilled laboratory staff could carry out a calbration of the instrument after which it would give accurate results for up to two weeks. Equipment of this nature should be extremely useful to supply houses engaged on the routine testing of large numbers of samples.

MR. D. E. WEIMER (M. L. Alkan Ltd.) asked whether Mr. Langford was of the opinion that cleaners and acid dips should be subjected to routine testing and control, and if so, which methods he would recommend.

MR. K. E. LANGFORD, replying to the discussion said that some years ago he had worked out a scheme for making up a cleaner which could be easily analysed, but it required the plater to weigh out a number of constituents for making up the solution each day which was unpopular compared with the ease of tipping into the solution the appropriate quantity of a proprietary cleaner straight from the drum. Control usually consisted of making up a cleaner at frequent intervals and throwing it away whenever the plater considered it too dirty for further use. This deprived the plater of an excuse for his rejects, but a more tight control both on cleaners and dips would certainly be an advantage if it could be effected without alienating the good-will of the plater.

* * *

ABSTRACT

THE CONTROL OF ELECTRODEPOSITION PROCESSES BY EXAMINATION OF THE DEPOSITS

*T. E. Such, B.Sc.**

VERY often examination of electrodeposits is confined to a cursory visual examination during swilling, and a more thorough examination is delayed, so making it difficult to relate the deposit to any particular load or vat. Although appearance is vital it is essential to take into consideration such factors as thickness, adhesion and physical properties.

Many variables can be checked at the vat side, by a regular routine examination, the results of which can be noted in a record book or on a chart. Combined with simple tests such as *p*H and hydrometer readings the above procedure often can make a reliable substitution for wet analyses.

*W. Canning & Co. Ltd.

Although properties that are greatly influenced by agitation (*e.g.* pitting and roughness) are often best judged on the work itself rather than test-pieces unless these are plated in the production vat, brightness and levelling power are better checked on standard test-pieces, either in the vat or in a smaller container, using vat solution, if quantitative results are required.

To obtain the current-density range for satisfactory deposition, particularly brightness, the Hull cell is recommended, but, although this cell can be used to give some idea of covering power, the bent-cathode test is preferred for this purpose.

Although pitting can usually be judged on the work being plated, small-scale tests may be helpful if the agitation can be standardized. This is easy for mechanical movement of the cathode and by no means impossible for air agitation.

Simple tests for adhesion fall into four types, *viz.* deformation, file, burnishing and heat tests. Deformation testing may be by simple bending or by the Erichsen or B.N.F. spiral ductility test. The file test is conducted by applying the file in a manner best calculated to raise the deposit. To be sure of sound adhesion it is necessary to penetrate through to the basis metal and still not remove any part of the deposit.

The burnishing test comprises the repeated rubbing of a small area of the plated object with a smooth metal object, while the heat tests rely on the difference in the coefficients of expansion between the deposited and basis metals.

For porosity, the sulphur-dioxide accelerated corrosion test, which will show up defects in nickel plate, such as thin spots where "masked" pores have been bridged over, is preferred to other tests including the "ferroxyl" test. Immersion in 1 per cent (V/V) HCl is suitable for cadmium, and a chromium plated article can be made the cathode in acid copper sulphate.

Visual examination is still widely used for determination of smoothness, but the Guild reflectometer, the Gardam surface truth instrument, the microscope, the Philips Roughness Tester, and the Talysurf can all be used.

For the assessment of ductility it is usual to test the actual deposit. Such methods as simple bend tests, bending the peeled plate and closing it up in the jaws of a micrometer, the hydraulic bulge test, and the B.N.F. spiral bend test can all be used. Not only can results of ductility tests be used to anticipate when cracking of the deposits is likely to occur but they can be taken as a measure of the amount of impurities in the plating solution, allowing remedial steps to be taken before plating rejects occur.

For hardness determinations a micro-hardness tester must be used on normal plated coatings. A scratch test has been suggested, but it is suitable only for soft and smooth deposits. Hardness values can be useful to indicate the contamination in a dull solution to show when purification is desirable.

Internal stress of electrodeposits requires special apparatus for its determination. Most methods depend on the deflection produced in a thin strip of metal when plated on one side only. The Spiral Contractometer and the Stressometer are other more developed versions of this test.

The value of any plating test is directly proportional to the extent to which it is used.

DISCUSSION

MR. R. A. F. HAMMOND (Armament Research and Development Establishment) said that Mr. Such had referred to a 20-year old paper by A. W. Hothersall and himself in which the hot-water test had been used for determining the porosity of nickel deposits. Work done subsequent to the publication of that paper had given rise to certain doubts as to the reliability of that test as it had been found that repeated tests on the same sample revealed large increases of porosity at each successive test. A large amount of work had been done to find the cause for this increase in porosity, but this had been halted by the outbreak of war before a satisfactory explanation had been found, and therefore the hot-water test could not be considered as absolutely beyond suspicion, although he would not care to agree entirely with Mr. Such that porosity testing was discredited.

With regard to Mr. Such's recommendation of the tensile test as a means of measuring the ductility of deposits he would be interested in having a more clear specification of the type of test-piece, which he considered suitable for that purpose. In view of the difficulties arising from necking or orange peeling on testing it did seem to be necessary to specify rather closely the mechanical properties and composition of the test-piece.

Mr. D. E. WEIMER (M. L. Alkan Ltd.) said that he considered that actual plating tests were just as important a factor in solution control as chemical analyses. Furthermore, a certain amount of rejection was inherent in the article prior to plating and close inspection of the work before plating might well reveal the fact. He also emphasized the importance of taking regular routine checks of the current supply.

MR. E. A. OLLARD (Atlas Plating Works Ltd.) said with regard to porosity that there was still a considerable amount of uncertainty as to what was exactly meant by a pore and that the corrosion behaviour of the nickel deposit was very frequently modified by the presence of an overlying chromium deposit. There was a considerable number of variables, some apparently quite minor, which

could have a profound effect on attempts to set up a standard method of test. The presence of a discontinuity could, under certain circumstances, lead to rapid corrosion of an underlying bright nickel deposit, whereas the nickel deposit, if tested, without the chrome layer might give very different results. It was very hard to get any real degree of consistency under those conditions where a discontinuous chromium layer was applied to a nickel coating deposited in the fully bright condition.

MR. J. SPRAGUE (Consultant Electrochemist) asked Mr. Such if he would state which of the testing methods mentioned in his paper he considered to be most useful for use in a moderate sized plating shop.

He expressed some doubts about the validity of a heating test for adhesion, while the mechanical stylus as a means of measuring surface roughness was heavy on maintenance. He felt that there was a real need for the development of an effective method of optical measurement for surfaces.

On the subject of porosity he wondered whether the incorporation of a wetting agent in the solution when carrying out the ferroxyl test to assist penetration into the deeper pores on a thick deposit.

DR. J. EDWARDS (British Non-ferrous Metals Research Association) dealing with the reference to the relative corrosion resistances of bright and dull nickel, commented that it would not be proper to regard the question as settled. His own experience, based on a number of exposure tests, had been that there was very little to choose between dull and bright nickel with the normal top coat of chromium, but that was not to say that they both behaved in the same way. In general the tendency was for a dull nickel coating to show a larger number of small pits, while bright nickel had a few large pits which developed rather quickly.

MR. P. QUINN (Englsh Electric Co. Ltd.) said that he felt that there was a danger of the results of porosity tests and accelerated corrosion tests being misunderstood by the users of electrodeposited coatings ; engineers tended to think that passing a specified test was equivalent to offering a guarantee that a coating would stand up to service in a given atmosphere for a specified period. It was his view that these tests were valuable as acceptance tests but they were not reliable indications of service performance because in general service conditions were so variable.

Replying to the discussion MR. SUCH said that his experience had shown that porosity tests were



During the recent one-day Symposium on "Technical Control in Electroplating" the opportunity was taken by W. Canning and Co. Ltd. to exhibit some of their test equipment at the Charing Cross Hotel.

Test sets for the use of plating shop personnel were on show, so designed that no knowledge of chemistry is necessary. The calculations are simplified and where possible direct burette readings give ounces per gallon of the specific constituent being checked. Sets were shown for the analysis of anodizing, pickling, passivating and most plating solutions.

Other items exhibited included hydrometers, voltmeters, and the B.N.F. Jet Test Set for thickness testing of deposits and comparator papers for the simple and rapid determination of the acidity of nickel solutions.

The item which appeared to stimulate the most interest was a new salt spray cabinet suitable for both salt and the more recent acetic acid-salt spray testing procedure. This unit is constructed in Perspex and provided with a water jacket to permit tests to be carried out at elevated temperatures. The unit is employed for the accelerated corrosion testing of plated and other finishes, and enables the relative durability of finishes to be determined.

The new "Canning" Salt Spray Cabinet is designed to conform with all existing and proposed specifications of the British Standards Institute and the AS.T.M.

not of much use in revealing pores on the thicker nickel deposits to B.S.S. 1224 and in these cases he considered the sulphur dioxide or acetic acid tests to be more valuable.

On the subject of tensile testing it was to be regretted that no standards existed in this connexion at the moment, but be believed that one was under consideration by B.S.I. From a practical point of view the best choice was to use a basis metal which corresponded as closely as possible to that in most general use. If the test had to cover a wide range of basis metals his choice would be for a flat test-piece made of brass, because that offered a reasonably ductile base.

He entirely agreed with the need for inspection of articles before, during and after plating as a necessary complement to solution analysis.

In reply to Mr. Sprague's question about test equipment for a medium-sized plating shop, the position was, of course, influenced by whether or not the shop was a department of a large engineering organization. If such were the case this should provide access to a Vickers hardness tester and possibly a tensile tester as well as equipment for measuring smoothness optically in the gauge room. But even in the case of the small trade platers without access to such equipment there was still a lot that could be done. For example, a thin strip test-piece could be plated and bent round a cylinder of known radius and the behaviour of the coating could be a very good guide to the state of the solution, but it should be done sufficiently frequently to give properly comparable results. He agreed that there were certain undesirable features about the heat test for adhesion and he preferred the file test, but on zinc pressure die castings the heat test could be a very useful tool. The addition of a wetting agent in the ferroxyl test seemed a good idea to help penetration but the main trouble seemed to come not from pores which penetrated right through to the basis metal, which were fairly easy to protect, but from masked pores which were only very thinly masked and soon opened up in service. As far as the use of optical instruments for the measurement of surface roughness was concerned he felt that they called for rather more skill in use and a principal objection to them was that the upper limit of roughness which they were capable of determining was not very great, whereas the electrical tracer type of instrument had a much wider range going up as high as 200 micro-inches.

He entirely agreed with Mr. Quinn that it was a fundamental error to try and interpret the results of an accelerated corrosion test in terms of a guaranteed period of service life. The results of such a test could be an indication that a deposit had been properly put on but to attempt to go further than this would be foolish.

ABSTRACT

TROUBLE-SHOOTING IN THE PLATING SHOP

*C. F. Corfe**

TROUBLE-SHOOTING is expensive in that production has to be slowed up or stopped while investigations are carried out to ascertain the cause and to cure faulty deposits. Too often, time allocated to cleaning and maintenance is taken up with urgent plating requirements only to cause a greater hold-up to production when a solution becomes unbalanced or equipment fails. Too infrequent replenishments or replacements of solutions, poor rinsing techniques etc. are also causes of poor plating, but if the above are being effected satisfactorily then a sudden lowering of quality is due to some change which must be found quickly and cured. At the first sign of trouble it is essential to narrow down the possible cause to a preplating, plating or post-plating cycle.

As regards pre-plating, care should be taken to ensure that the degreasing plant is operating correctly and that polishing compounds are not trapped in blind holes and recesses. Water dilution of emulsion cleaners should be avoided and the operating temperature should not be allowed to fall below 500°F. Main cause of trouble with soak cleaners is also too low an operating temperature.

Defects caused by electrolytic cleaners can be due to low temperatures and infrequent replenishments. Cathodic cleaners are dangerous when impurities are present. If stainless-steel anodes are provided they should be used with caution because of the danger of chromium contamination. Anodic cleaners are not so susceptible to contamination. With both types of electrolytic cleaners care must be taken to ensure a correct current density.

If water pressure is low then weir rinse tanks may be considered ; spray rinsing should be used with caution when cupped articles are being processed. Pickles should be replaced regularly and not just replenished ; when plating on aluminium, failure to renew the pickle acids regularly can only result in disaster. Heavy grease contamination shortens the life of alkaline de-rusters which are often also used as cleaners.

At the first sign of a lowering of plating quality action should be taken to ensure that analytical results of the plating solutions are made available in the shortest possible time. In the meantime the pre-plating cleaners etc. can be checked by scouring a few components for test-pieces with pumice powder and lime. If the pre-plating sequences are in order and the plating solution suspect, action can be taken by observing unusual

*M. L. Alkan Ltd.

symptoms or appearances of the solution, anodes or deposit.

To get a true picture of the deposit the use of the Hull cell is invaluable, and tables in the paper give a guide to the results obtained with the cell for various electrolytes including most of the proprietary solutions.

The "bent-cathode test" is also well known and where a Hull cell is not available, changing conditions in the solution can be interpreted regarding throwing and covering power, together with the effects of certain impurities. Trouble-shooting charts built up from practical experience can be invaluable practical assets.

The post-plating cycle exposes poor rinsing techniques with staining, spotting-out and accelerated corrosion of the components. The use of drag-out tanks to reduce effluent problems is to be recommended, but when used for replenishing and "topping-up" the plating solution, care should be taken that impurities are not reintroduced.

The staining of parts after rinsing and drying is often troublesome and the use of distilled water or dewatering fluids may not solve the problem. Slow withdrawal has been found to be useful; another method is to blow off surplus water with compressed air followed by oven drying.

Troubles most encountered with chromate dips are dilution through drag-in; there is also a tendency to restrict the size of the tanks on economy grounds making it impossible to agitate the components or basket sufficiently.

DISCUSSION

MR. W. T. LEE (Silvercrown Ltd.) said that Mr. Corfe had dealt very fully with the Hull cell and this was no doubt a very generally useful piece of equipment, but it was capable of being modified to extend its usefulness. Similarly with regard to the bent-cathode test much useful information could be gained from the manner in which the panel was bent. A fairly recessed bend would give an excellent indication of throwing and covering power and sometimes of impurities. It could also be made more useful on occasions by punching a number of holes in the panel because production troubles quite frequently arose around holes. Again, by giving the bent panel a fairly long horizontal section as well it was often useful in determining the cause of pitting.

Many trouble shooters had developed devices and instruments of their own and he had found, in particular, two simple tests to be useful. A length of copper wire wound at random in the form of a ball could very often give a better idea of effects in low current density areas than did the Hull cell or the bent cathode. Another simple test was to hang a loop of copper wire in the bath and use it as a surface tension wire which frequently gave a better indication of deficiency or excess of anti-pitting agents than could the Hull cell.

It was important that trouble shooters should be equipped with the necessary instruments. For example, current-density meters and tong testers were very useful on occasions as also was a portable throwing power meter.

MR. H. CANN (W. Canning and Co. Ltd.) stressed the need for ensuring that all operating solutions were of the composition laid down by the supplier. He also pointed out that it was well worth while conferring with the operator of the solution, who, in many cases was far more observant than he was sometimes given credit for. By correlating the observations and experiences of a number of operators it was usually possible to establish some sort of pattern of behaviour which would prove both valuable in attempting to locate faults.

MR. E. F. MARLOW asked if there was a simple shopfloor test for metallic impurities which did not involve the need for buying expensive instruments.

MR. E. A. OLLARD (Atlas Plating Works Ltd.) said that one of the most important things to do when trouble shooting was to establish a probable place at which the trouble was occurring in the long chain of operations between the initial fabrication and the finished product. Many troubles which arose were not initiated in the plating vat or in the plating shop itself, and a very detailed examination, including a good micro-section might often establish the real source of the trouble.

Most of the troubles which could not be identified could be attributed to contamination of the solutions, and in most cases the plating solutions. Contamination, and particularly organic contamination, where as little as one part in hundred thousand could cause trouble was virtually impossible to identify. It was only possible to draw the inference that if treating the solution for organic contamination cures the trouble, organic contamination was probably responsible.

MR. CORFE, replying, said that although the Hull cell was not the ultimate form of quick test, generally speaking it did show results. Its value, particularly for the detection of metallic impurities could be greatly increased by preparing a library of comparative panels. For example, by adding increasing concentrations of copper to a silver solution and plating some six panels, these would constitute a fair guide to the presence of metallic impurities.

The point made by Mr. Ollard about tracing the source of the trouble backwards in the production schedule was all very well in the plating department of a manufacturing or engineering organization, but in a jobbing shop no control over the manufacturing process could be exercised, which made the position much more difficult.

ABSTRACT

REQUIREMENTS AND INSPECTION OF METALLIC FINISHES FOR SERVICE EQUIPMENT

*D. W. Smith**

THIS paper outlines some of the problems associated with the requirements laid down for metallic finishes used on Service equipment.

Although some metallic finishes are used as corrosion protection there are many applications where a particular coating is required for reasons unconnected with corrosion protection. In general, however, if the coating gives some protection against corrosion of the base metal and is itself not easily corroded, so much the better. In some circumstances, however, it may be a requirement that the coating metal should corrode.

Services equipment has to be used in a wide variety of environments, corrosive and otherwise, but more often than not, the selection of a particular metallic material for a particular function is governed by reasons other than corrosion resistance, *e.g.* mechanical properties, ease of fabrication, availability, etc. etc.

Most of the protective metallic finishes are specified to D.T.D. or B.S. specifications, and considerable progress has been made in the standardization of requirements for protective finishes and this work is continuing.

Much effort has been devoted to evolving tests that would simulate the climatic conditions to which Services equipment may be subjected and to finding suitable protective finishes to withstand the ravages of the various exposure conditions. In addition, coating thicknesses now specified are the result of many careful tests, both laboratory and long-term exposure.

When choosing a metallic finish for corrosion protection, the normal principles of cathodic protection are utilized and sacrificial coatings are adopted where possible although there are exceptions to this.

Severe mechanical shocks arising from transit handling also have to be considered, resulting in great attention to packaging. It has been found that cadmium is particularly susceptible to vapour corrosion and that zinc, magnesium and lead may also be effected. Tin coatings are resistant to this form of corrosion as are most aluminium alloys and stainless steel. Vapour corrosion can be inhibited by, in some cases, a chromate passivation or by lacquering, or painting. Tin coatings must be thick enough to ensure freedom from pores. Vapour corrosion is often intensified if ingress of air to the components is prevented.

*Inspectorate of Electrical and Mechanical Equipment, M.O.S.

High-strength aluminium alloys in the form of relatively large extrusions may, in some circumstances, suffer a disastrous form of layer corrosion, and this can be further accentuated by galvanic effects due to bolted- or riveted-on steel fittings.

As most of the tests for coating, quality, particularly for electrodeposited coatings, are laboratory tests, many of which are destructive, " representative " samples have to be taken and therefore testing is seldom on a 100 per cent basis. However, it is possible to inspect for colour, blisters, uncoated areas etc. on the shop floor.

It is standard practice to check the type of coating metal before carrying out thickness tests and for this purpose a simple series of spot tests is used. For " shop floor " testing of electroplated coatings on ferrous bases, the pull-off magnetic pencil-type tester has been found to be extremely useful; magnetic methods should, however, be used with discretion.

Another " shop floor " test used for local thickness on small cadmium-plated parts is that mentioned to the author by F. Taylor in 1945. It involves dipping in two solutions, the first containing CrO_3 and HNO_3 and the second HCl. Each 15-second dip in the first solution removes 0.00005 in. of metal, in the case of cadmium ; with slight modification the method can be used for zinc.

Sprayed metal coatings are finding increasing use, and for local thickness testing of sprayed zinc or aluminium the Drewitt thickness tester, which is simple in design and operation, is used. This tester can also be used for paint coatings, special-purpose electrodeposited coatings and hot-dip galvanized coatings.

The inadequacy of reliable non-destructive testing methods for protective metallic finishes places a heavy responsibility on the processing operators, supervisors and management to produce good work.

DISCUSSION

MR. A. FREEMAN (Marconi Wireless Telegraph Co., Ltd.) referred to the requirement in the Services Specification for plating on electronic equipment that cadmium deposits on copper alloys should have an undercoat of either tin or nickel. He had been unable to find any references to this process and had been given to understand that work carried out at the B.N.F.M.R.A. had shown that the danger of cadmium diffusing into copper alloys did not exist.

He was also concerned about the reduction in thickness of cadmium specified for screwed parts of small diameter, although he appreciated the problem of build-up on screw threads, he did not consider that .15 mil. of cadmium was sufficient to give adequate protection.

(*Continued in page* 476)

Spotlight . . . . . on the . PLATING LABORATORY

by D. J. FISHLOCK

TO the smaller plating shops, employing only one or two persons on chemical control, investment in analytical apparatus much more expensive than the standard range of glass-ware appears difficult to justify. A good case can be made, though, for some such expenditure if account is taken of the following points :—

(a) control analyses can usually be greatly hastened by using instruments, and appreciably speeded by using the more ' stream-lined ' conventional apparatus. This can be invaluable when a process is in trouble apart from its general desirability.

(b) routine plating solution analysis tends to be somewhat uninteresting—more so if nearly all of the estimations are volumetric ones.

(c) personnel will probably be freed to devote more time to physical control of deposits, to the more thorough investigation of proprietary and newly developed processes, and to implementing improved methods of analysis.

(d) the enthusiasm of laboratory personnel is much more likely to be retained if the techniques are kept abreast of those in other analytical fields.

There appear in the plating literature many very elaborate techniques suited only to a well-equipped metallurgical analysis laboratories : typical ones are those involving the polarograph and the micro-balance. At the other end of the scale, however a number of improvements in speed and efficiency are possible for quite a small outlay. An example is the use of the automatic burette, which eliminates the need for frequent changes of burette on repetition work. Two types are available ; one has the reservoir at the top, and in the other the storage bottle is the reservoir and the burette attaches to the stopper. They have a capacity of 500 cc. and 1 litre respectively, and are available in dark glass for unstable solutions such as silver nitrate and thiosulphate.

Safety pipettes are—or should be—standard apparatus in any plating laboratory, especially if the staff are not fully experienced. Two types are available ; one has a ground-glass joint which needs slightly greasing, but the more recent is a range of pipettes which can be used with an interchangeable polythene adaptor and a standard syringe, Fig. 1. The latter is inexpensive and easy to clean, and at least as easy to use as the conventional pipette.

The bunsen burner is probably the most familiar item of laboratory equipment, but can often be advantageously replaced by the basket-type electric heater for flasks. This ensures more uniform and steady heating, and reduces the fire-risk when working with solvents. Miniature immersion heaters, which cost very little or can even be made from a length of resistance wire wound on to mica and fixed in a test-tube, are invaluable for slowly heating beakers or minature plating cells.

Plating tests have now become standard practice for certain solutions, notably bright nickel and other bright solutions where the addition agents do not lend themselves to ready analysis. The Hull-cell is the most familiar one, its principal uses being the control of addition agents and of metallic impurities ; it can, with experience however, be extended to assess major constituents and other contamination. Such cells are readily constructed from Perspex joined by a solution of it in methylene dichloride, but can also be purchased in several inert materials and with built-in electric heaters if so desired. There is also a design which can be hung directly in the plating vat or on the conveyor which can be used

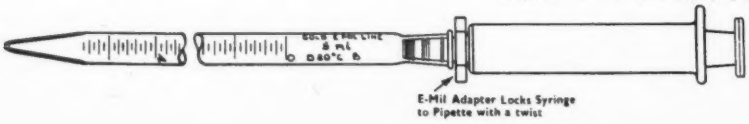


Fig. 1.—The E-Mil safety pipette with an interchangeable polythene adapter to couple it to the syringe.

(Courtesy, H. J. Elliot Ltd.)

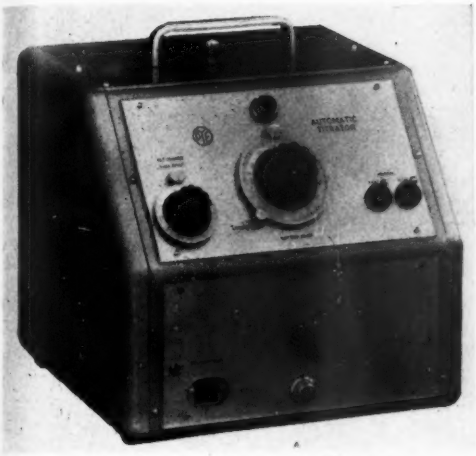


Fig. 2.—(*above*) *Automatic titrator for use with a pH meter and delivery unit.*

(Courtesy, W. G. Pye and Co., Ltd.)

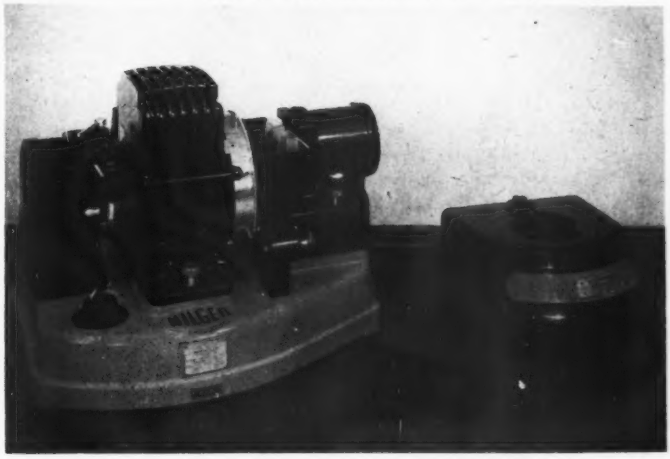


Fig. 3.—(*right*) *The "Spekker" photo-electric absorptionmeter with its null-point indicating galvanometer.*

(Courtesy, Hilger and Watts, Ltd.)

arity of the direct *p*H meters. These can be used for every solution in the plating shop the *p*H of which is of significance and give a reading accurate to 0.05 *p*H in a few moments. Potentiometric titrations of such solutions as the phosphating ones is often done to avoid the complications of end-points obscured by precipitates and an interesting extension of this technique makes use of an automatic titrator, Fig. 2. This is used in conjunction with a direct-reading *p*H meter and comprises a special electronically controlled delivery unit. The latter is fed from a burette of the titrating reagent and has two delivery taps—fast and slow. The fast rate is used until the reaction reaches a predetermined distance from the end-point when the delivery unit automatically switches over to the slow rate. This continues until a stable end-point is reached, and gives a result accurate to a single drop. An interesting incidental application is that by using two coupled instruments very close control of, for instance, the *p*H of a nickel solution could be achieved.

The photo-electric absorptiometer, Fig. 3, needs no introduction, and plays a very important role in many large plating laboratories for the rapid, accurate estimation of, in particular, the metal contents of plating solutions. Its versatility as an analytical tool has, however, led to the development of much simpler instruments which for the sacrifice of the versatility and accuracy are considerably cheaper, Fig, 4. These are of inestimable value for speedy plating solution analysis, *e. g.* of nickel copper, tin, iron, cobalt, and many metallic impurities in effluents and plating solutions, and of certain brighteners in plating baths.

The laboratory still, expensive to run, and fraught with scaling troubles, is something of an anachronism today when portable deionizing and

to assess cleaning efficiency as well as the plating conditions as they actually exist in the vat.

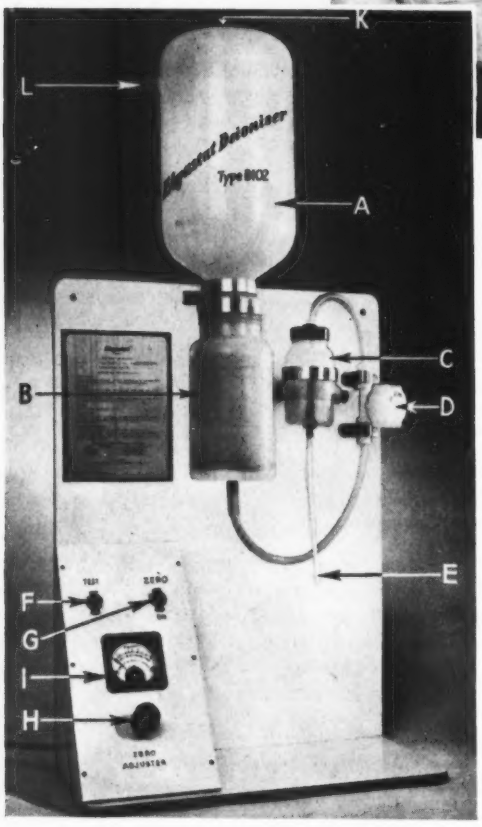
The determination of sulphate catalyst in the chromium solution remains a teaser for rapid, accurate estimation. However, the Hull cell can be used for control and will give every satisfaction.[1] Freshly nickel plated panels are chromium plated at 5 amp. for 4 minutes at 110°F. (43°C) (or at the normal operating temperature). The plate is then examined for brightness, uniformity, covering, and absence of iridescence. The test can be made in a 275-ml. cell or with the hanging cell, and takes account of the total catalyst and the trivalent chromium contents. Several other types of plating cell have been described, and these sometimes offer advantages with specific solution ; the hours spent on experimenting are often well justified later.

Instruments undoubtedly have a place in the plating laboratory—witness the widespread popul-



Fig. 4.—(right) The very compact prism absorptiometer for rapid colourimetric and absorptiometric estimations
(Courtesy, Unicam Instruments, Ltd.)

Fig. 5.—(below) Elgastat B103 deionizing unit with flow rate up to 3 gal. per hour. A—storage tank, B—resin cartridge, C—conductivity cell, D—flow control valve, E—effluent pipe.
(Courtesy, Elga Products, Ltd.)



demineralizing units are available. These require no storage of water and supply a quality at least equal to and if required far superior to the distilled product often at much lower cost. A wide range of deionizing units, from the tiny bench model producing up to 3 gallons an hour of a quality equal to three distillations in quartz, Fig. 5, to units with outputs of 50 gallons an hour upwards.

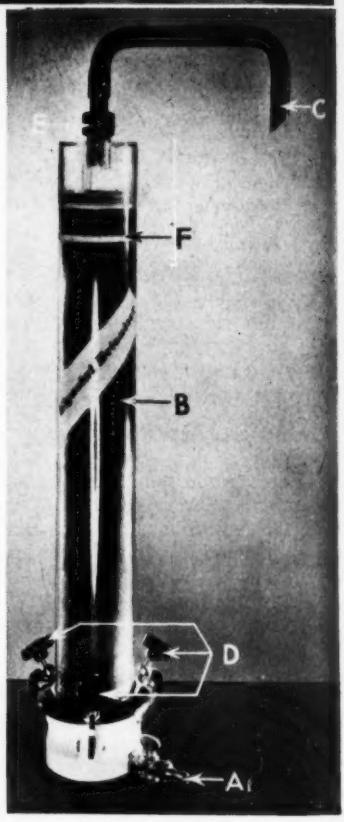


Fig. 6.—(right) Elgastat Major deionizing unit with flow rate up to 15 gal. per hour. A—tap water influent valve, B—resin cartridge, C—effluent pipe, F—conductivity monitor.
(Courtesy, Elga Products, Ltd.)

In the smaller units the cartridges of ion-exchange resin are returned to the manufacturer for re-

(*Continued in page* 476)

Some Experiences in the Use of "ZERO-MIST" in HARD CHROMIUM PLATING*

By Vicente Massuet GRAU†

Introduction

THE fact that the author has considered the study of the possible use of Zero-Mist in hard chromium solutions of interest, although this product was intended to be used only in bright chromium plating baths, might at first seem strange, and therefore a preliminary explanation is required.

In Spain, hard chromium plating has more industrial applications than in other countries, due especially to the great difficulties that the country has suffered, and which have not yet completely disappeared, in the manufacture, treatment, and use of alloy steels with the high mechanical and chemical resistances necessary for many technical applications.

As early as 1936, the author worked in Spain on a special research programme termed at the time as "heavy chromium plating" because "hard chromium" had not yet appeared. Among the samples plated were some spiral-shaped textile machinery parts inside which there was a fast-moving thread on which appeared, even in the best heat-treated alloy steels available at that time, thin scratches which eventually broke the thread. After about 20 years, many chromium-plated parts with a thickness of 0.08 mm. are still in use without showing a single scratch. Probably in other countries this problem would have been solved by improving the steel alloy or by better heat treatments.

It is not surprising, therefore, that in Spain today, there are some hard chromium plating plants with a current output of more than 15,000 amperes, and that the consumption of chromic acid in hard chromium is much greater than for decorative purposes. At present, for instance, the author's company is building two vats 5 metres deep for the hard chromium plating of gun barrels to be used in the Spanish Navy. In 1941 machine-gun barrels of 7.92 mm. inside diameter were being plated.

In order to cover the growing need for Spanish technical literature on this subject, the author has recently published a 500 page technical book, (the only one written in Spanish on hard chromium plating) of which up to the present about 1500 copies have been sold.

The great interest in the use in Spain of Zero-Mist not only in bright chromium plating but also in hard chromium plating is evident, especially bearing in mind that the chromic acid manufactured in this country although at present of a standard quality and being produced in big enough quantities, has a price double that manufactured abroad.

Furthermore, the majority of hard chromium plating tanks are of a special design, as for instance, those used for plating large cylinders, and sometimes, the fume exhausting system presents serious problems which would be overcome if it were possible to use Zero-Mist.

The initial plan of work was divided into three stages, the first and second, having been concluded.

(1) For this first stage a 5-litre unit provided with automatic temperature control was used, in which eight test-pieces were plated in a vertical position, four of them Nos. 1 to 4 in a bath without Zero-Mist and Nos. 5 to 8 in a similar solution containing Zero-Mist. The solutions were of standard composition (250 gm. per l. CrO_3 and 2.5 gm. per l. SO_4H_2). The test-pieces were of F-111 steel (*See* Table I) and had been ground on their cylindrical surfaces with a coarse wheel, whereas on their bases they had been left as they came from the lathe. The material used had not been heat treated. The pieces had a surface area of 0.5 sq. dm. Working conditions were in all cases 52°C. and 50 amp. per sq. dm. Half the test-pieces were plated for ½ hour and the rest for 1½ hours. Zero-Mist was added in the proportion of 4½ tablets per litre.

The initial tests showed that the parts treated in the bath with Zero-Mist had on their lower base, large black nuclei (*See* Figs 1 and 2), whereas in neighbouring parts nodules and some pitting could be seen (Fig. 3).

In Figs. 4a and 4b, showing sections of the base of test-piece No. 4, there appears to be pitting arising from one of the characteristic inclusions that are formed in the chromium deposit.

The rest of the surface of these test-pieces had a normal bright chromium deposit without any of the above abnormalities. Apparently these results are

*Based on a Paper presented at The Efco-Udylite Distributors' Conference October, 2nd, 3rd and 4th, 1957.

†Instituto Electroquimica S.A.

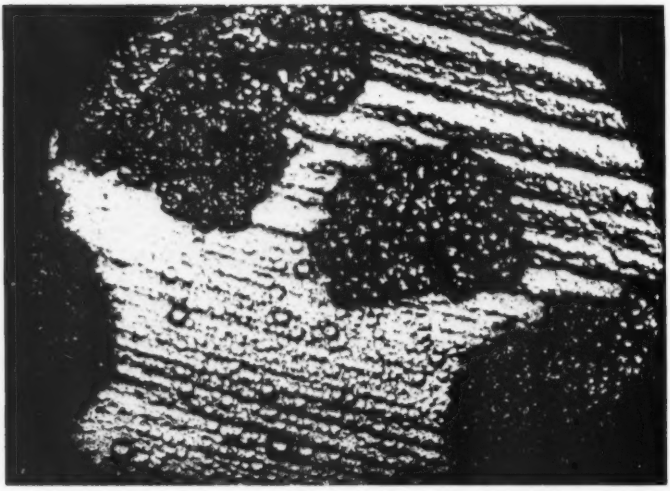


Fig. 1.—*(left) Clusters of nodules formed on the base of test-piece* 3 (*x* 100).

Fig. 2.—*(below) Partial view of a group of nodules in Fig.* 1 (*x* 500).

in accordance with P. J. Ramsden's remarks [1] and the formation of pits in the base of the test-pieces could be influenced by the different degrees of mechanical finishing, which, as previously stated, were not the same on the cylindrical surfaces as in the base of the test-pieces.

(2) In view of these results it was decided to initiate a second semi-industrial stage in which an attempt was made to see the influence that : (a) the type of surface finishing, (b) the composition of the base metal, and (c) the working conditions (current density, temperature, etc.) had on the formation of pits.

With that purpose, a 40-litre hard chromium bath of standard composition was made up in a tank heated with thermostatically controlled quartz immersion heaters. To this bath were added 4½ tablets of Zero-Mist per litre.

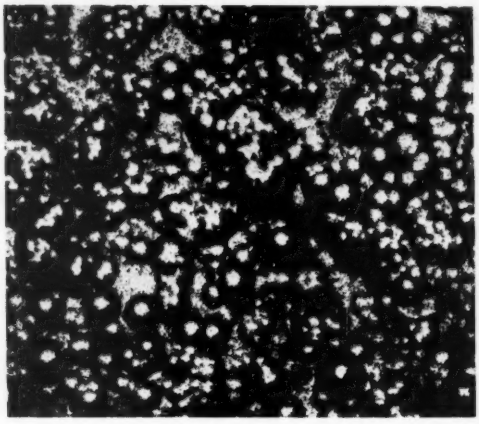


Table I

Iron and Steels

Specifications			Chemical Compositions in per cent							
Spanish I.H.A.	British ESC Vickers	German Old Din.	C	Mn	Si	P	S	Ni	Cr	V
F-111	A-5	C-15-St-1061	0.21	0.48	0.25	0.03	0.02	—	—	—
F-516	XX-B	C-115-B.2	1.10	0.60	0.28	0.038	0 03	—	0.40	0.15
Mild Steel			0.27	0.52	0.23	0.050	0.045	—	—	—

Coppers and Brasses

Specifications	Chemical Compositions in per cent				
	Cu	Zn	Fe	Pb	Sn
Copper	99.8	7	—	—	—
Brass No. 1	52.0	47.0	0.3	0.6	—
Brass No. 2	58.1	40.9	0.3	0.5	0.1
Brass No. 3 (Cast)	65.1	32.7	0.9	0.7	0.5

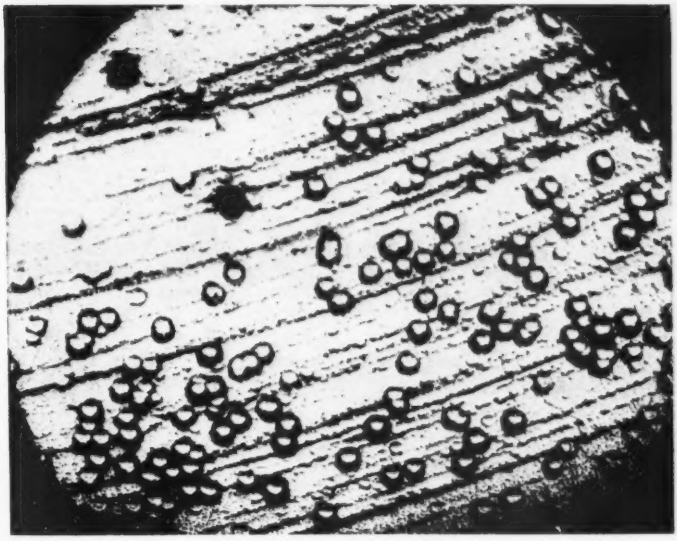


Fig. 3.—Large nodules scattered on the base of test-piece 3. Two pits appear in between the nodules (x 100).

As the chromic acid then in use was commercial quality, it was passed through a filter made of porous plates covered with a 3 to 4-mm. layer of pure washed asbestos and activated carbon thoroughly mixed [2]. The solution had, after filtration, the characteristic red colour of a new chromium solution. After adding sulphuric acid and Zero-Mist the analysis was as follows : CrO_3, 251 gm. per l. ; H_2SO_4, 2.49 gm. per l. ; Cr_2O_3 and Fe_2O_3, less than 0.1 gm. per l.

Analyses were made by usual methods and the sulphate content was checked by the rapid method given by K. E. Langford[3].

In order that the solution should correspond more similarly to the composition of a bath already worked, some material was plated for several hours in order to render a small amount of Cr_2O_3. After this the experiments were carried out.

A set of 16 cylindrical test-pieces numbers 9-10-11H-11V-12H-12V-15H-15V-16H-16V 19H-19V-17-18-20H-20V, with a surface of ½ sq. dm. was prepared with the steels shown in Table II. The degree of finish appears in Table IIB.

The normal work cycle in the preparation of these test-pieces was as follows :

Degrease in trichlorethylene vapour
Cathodic clean in Efcolene solution for 4 min.
Cold-water rinse
Anodic clean in Efcolene solution for 3 min.
Cold-water rinse.
Anodic etch in a separate hard chromium solution for 15 to 45 seconds and from 20 to

Table II

Classification of the Test-Pieces According to Their Composition.

Piece No.	Material	Piece No.	Material
1- 2- 3 4- 5- 6 7- 8- 9 10-11-12 88	F-111	21 22 23 24	Copper
13-14 15-16	F-516	25-26 27-28	Brass 1
17-18 19-20	Mild steel	29-30 31-32	Brass 2
33-34		35-36	Brass 3

Table IIb

Mechanical Finishing of Test-Pieces

Test-Piece Number.	Kind of Mechanical Finish
1- 2- 9 13-17-21 25-29-33	Turned on the lathe and ground with a coarse abrasive (No. 20).
3- 4-10 14-18-22 26-30-34	Turned with slow feed and ground with a fine abrasive (No. 50).
5- 6-11 15-19-23 27-31-35	Turned with fine feed and ground with a very fine abrasive (No. 120).
7- 8-12 10-20-24 28-32-36	Turned with a very fine feed and polished with emery paper (No. 0000).

Note 1.
Test-pieces used in these experiments had the following dimensions: 20 mm. 100 mm. long, of which only 80 mm. were chrome plated, while the rest of the pieces were masked.

Note 2.
The rest of the test-pieces were of the same dimensions and F-516 steel. Approximately 4 cm. were hardened in molten salt baths. After this treatment the whole piece was ground.



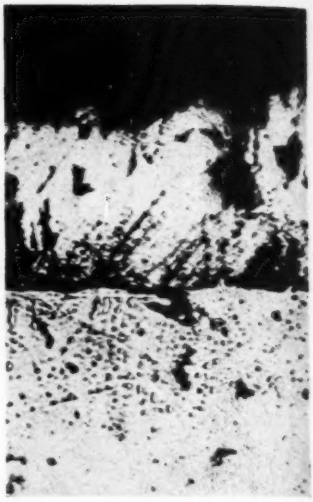


Fig. 4.—(a) (left) and (b) right Transverse section of two pits (x 500).

100 amp per sq. dm. according to thickness of chromium.

Hard chromium plating.

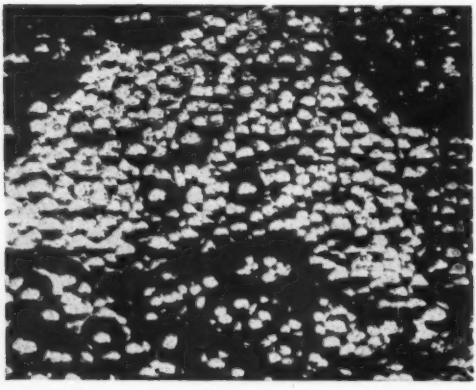
Moreover with the purpose of finding out at the same time whether the position of the cathode in the chromium bath could have affected the formation of pits, two test-pieces of the same material with the same degree of mechanical finish were treated simultaneously. One of them was plated vertically and the other horizontally.

Working conditions for all these test-pieces were 52 $\pm$ 2°C and 50 amp. per sq. dm. Plating time was 4½ hours. Table III shows results and conclusions from test-pieces 9 to 20.

Tests on Brass and Copper

Continuing this second stage tests were begun with copper and brass parts (*See Table* II) under the same working conditions stated above for the steel test-pieces. Results are shown in Table III and in Figs. 5, 7 and 8.

Fig. 5.—Thick cluster of nodules. Base metal, Brass No. 2 (x 100).



It is interesting to note that none of the copper and brass parts, with the exception of those made of cast brass No. 3, had any imperfection in the chrome coating. In the cast brass some pits were seen mainly around the edges of the test-pieces.

After plating all the test-pieces, the solution had been operating for some 125 hours with an average current density of 1.66 amp.-hr. per litre of solution.

Analysis at the end of this stage was as follows : CrO_3, 240 gm. per l., H_2SO_4, 2.43 gm. per l., Cr_2O_3 and Fe_2O_3 = 3.8 gm. per l.

Content of Zero-Mist was checked by means of a stalagmometer. Comparing the values obtained now with the value of the initial solution, also having in mind any possible errors, results agreed, and consumption of Zero-Mist was practically negligible.

Although the anodes usually supplied for both hard and decorative chromium-plating are made of a 90/10 lead-tin alloy (the lead 99.8 per cent purity), at the present stage anodes of pure lead sheet were used.

In the course of this second experiment, it was noted that anode corrosion products were of greater volume and darker than usual and quite powdery in parts. Such sediment, however, was mostly lead dioxide.

After this test, it was considered of interest to continue plating some samples (F.516 steel) for another 125 hours. During this period it was noted for the first time that working as before at 50 amp. per sq. dm. and at 50 $\pm$ 2°C. the solution became very sensitive to the formation

Table III

Appearance of Chrome Plate in the 1st Series of Test-Pieces

H = Test-piece plated horizontally.
V = Test-piece plated vertically.

Test-Piece	Material	Treatment time	Visual Inspection	Microscopic Inspection
1 2	F-111	30 min.	Bright deposit in cylinder. Its lower base shows nuclei of black nodules concentrated in one zone. (Plated in the small 5-litre equipment in bath with Zero-Mist).	Groups of nodules can be seen on one part of lower base (*See* Figs. 1 and 2). On rest of base, nodules appear uniformly distributed with some pitting in-between them. (*See* Fig. 3).
3 4	F-11	90 min.	Ditto.	Ditto. (*See* Fig. 4).
5 6 7 8	F-111	30 min. 90 min.	Normal bright deposit (plated in bath without Zero-Mist in 5-litre equipment).	Quite normal
9-10 13-14 17-18 21-22 25-26 29-30 33-34	F-516 Mild steel Copper Brass No. 1 Brass No. 2 Brass No. 3	4½ hr.	All these test-pieces independently of chroming position have quite a normal bright chrome plate.	No microscopic inspection was made of these test-pieces due their normal appearance to the naked eye.
11 H 11 V 15 H 15 V 19 H 19 V	F-111 F-111 F-516 F-516 Mild steel	4½ hr.	Bright deposit with nodules apparently of common type in hard chrome.	No abnormality was observed though deposit seems to become too nodular.
23 H 23 V	Copper	4½ hr.	Bright with fine nodules uniformly distributed perhaps due to surface irregularity formed in the preparation of base metal.	No microscopic inspection was made as no pitting could be found.
27 H 27 V	Brass No. 1	4½ hr.	Normal without pitting and very smooth	Normal.
31 H	Brass No. 2	4½ hr.	No pitting but large nodules on the ends. Apparently test-piece was plated somewhat obliquely. Groups of nodules have formed in zones of maximum gas evolution.	The clusters are formed of very small groups of nodules (*See* Fig. 5).
31 V	Brass No. 2	4½ hr.	On the base there appear nodules lined in radial form starting from a point on the surface.	No microscopic inspection was made.
35 H 35 V	Brass No. 3 Brass No. 3	4½ hr.	Small pits appear scattered on the edges	Ditto
12 H 12 V	F-111	4½ hr.	Bright deposit with some pitting located in opposed zones of horizontal axis. Bright deposit without pitting at 12 V	Ditto. Normal with small nodules.
16 H 16 V	F-516	4½ hr.	Bright without pitting.	Ditto.
20 H 20 V	Mild steel	4½ hr.	Bright with some pitting.	A section of a pit may be seen in Fig. 6.
24 H 24 V	Copper	4½ hr.	Normal bright.	No inspection was made.
28 H	Brass No. 1	4½ hr.	It shows two straight lines opposed at 180 deg. on the lower and upper parts of flat strangely shaped clusters of small nodules. Bright with a straight line of small pits (perhaps due to marks left by drawing die). The lower circle shows nodules very like those on test-piece 31 V though radial and more numerous on corners.	Inspection was not possible.
28 V	Brass No. 1	4½ hr.		
32 H 32 V	Brass No. 2	4½ hr.	Bright with nodules on the ends.	Ditto.
36 H 36 V	Brass No. 3	4½ hr.	It shows a large band of longitudinal pitting zones with large nuclei of pits on the ends.	Ditto (*See* Figs. 7 and 8).

Note: All the above test-pieces were treated at 50 ± 2° C. and 50 amp. per sq. dm.

of bright nodules (not those characteristic of hard chromium plating) which at times covered almost completely the surface of the pieces.

It was also noted that as the thickness of the coating in the present tests increased, nodules grew both in number and in size, as it is normal in hard chromium, but they had a tendency to disappear when the working temperature rose from 50 to 70°C. Likewise, they also disappeared by increasing both the current density and the working temperature, although beyond the limits acceptable for normal hard chromium plating.

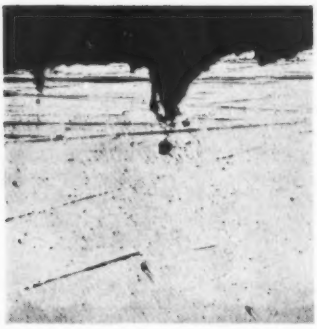


Fig. 6.—(left) Transverse section of a chrome-plated coating showing a pit formed apparently on a metallic oxide (silicate or aluminate) existing in the metal base (x 100).



Fig. 7.—(right) Upper view of the lower end of test-piece No. 36V, where a cluster of small pits can be seen. Base metal Brass No. 3 (Cast) (x 2).

Also plated were several other pieces made of "mild steel" rod (*See* Table I) with a slightly rough surface and some drawing marks. These pieces after being plated in normal conditions showed on their surface many pitted areas, which were more pronounced around the drawing marks.

With the aim in view of replating these same pieces, a part of each was cut off to be kept for reference. The chromium on the remaining parts was stripped in a 10 oz. per gal. caustic-soda solution at 6 volts. Afterwards their surfaces were activated in hydrochloric acid and plated again in the same position up to 70 amp. per sq. dm. and up to 70°C. They were replated with different thicknesses of chromium but pits appeared only in very few cases. Therefore it was concluded that by increasing the temperature and the current density, pits could be completely avoided.

From then on, systematic trials were made on test-pieces (F-516 steel) whose lower part had been hardened in a salt bath. As all these pieces had been ground, it was considered it necessary to induce pitting by imitating very small pits on the surface.

Then the solution was accurately checked. The temperatures and current densities at which it was planned to work were the following: 40, 50 and 70°C., and 30, 40, 50, 60 and 70 amps per sq. dm. The plating times were 30, 90 and 190 minutes, in order to establish the influence of working conditions in the formation of pitting. At 40°C and 30 amp. per sq. dm., no pitting was noted, although the coating was dull as would normally happen in hard chromium plating without Zero-Mist at the above lower figures.

The rest of the test-pieces plated at this same temperature and with the current densities stated above produced a bright or semi-bright chromium coating completely free from pitting.

It was realized that small black nodules began to

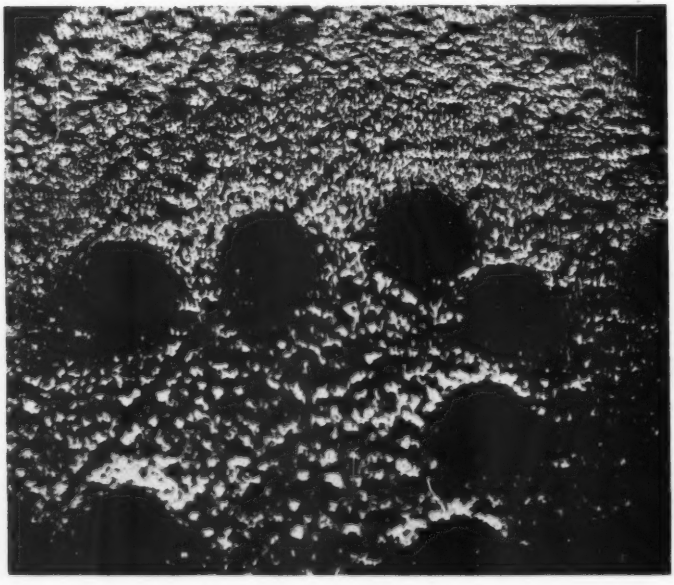


Fig. 8.—Enlarged view of Fig. 7 where pits are distinctly shown.

appear, which increased in number as the time of treatment and current density were increased. However, at 70 amp. per sq. dm. and 70°C, the nodules tended to disappear, although the coating was milky in colour.

As later a state was reached in which the coating was completely covered with these nodules even working under normal conditions, the tests were postponed in an attempt to determine the exact cause of such unusual nodule formation. Analysis showed that the solution was correct as far as the contents of trivalent oxides had reached 4.8 gm. per l. a value which did not, in the author's opinion, warrant the formation of any kind of irregularity.

It was presumed that the nodules could be due to the presence of solid matter in the bath, mainly residues from the anode, produced in the course of the tests. The solution was allowed to stand for 48 hours, and other test-pieces then plated, the deposit again showed the nodule formation although to a less extent. It was thus possible to note again that the cleanness of the solution had great influence on the quality of the deposit in all baths.

Conclusions

The conclusions arrived at concerning the action of Zero-Mist on hard chromium in the first and second stages of the work described are :

(1) There is a tendency to the formation of pits quite different from those produced in certain cases by normal hard chromium baths ; they can also be foreseen when surface metal imperfections are readily detectable by visual inspection or in those cases where the existence of pores (from casting, etc.) may be assumed to be present. There was only one single case of pitting on a test-piece with an apparently normal surface.

(2) The degree of mechanical finishing of the base metal has apparently little influence on the formation of pitting attributable to the use of Zero-Mist.

(3) As the solution ages, it has a tendency to produce rough coatings with many peculiar large nodules all round the edge on the base of test-pieces. Although this may be due to abnormal sediments produced probably by the action of Zero-Mist, it should be noted that in this stage pure lead anodes were being used. Thus, it can be stated that pitting is not usual in the initial periods, but rather after some hours of worked have elapsed (in the case described about 95 hours.) In an industrial tank this defect would perhaps be less noticeable as there would not be such a strong agitation as in the case of all small baths. It is well known that a similar defect is occasionally observed when hard chromium solutions are stirred after an addition or correction, and also that pits increase both in quantity and in size as the solution becomes older, mainly in the zone of high current density, *i.e.* where there is a stronger gas evolution. During the tests there seemed to be an apparent partial decomposition of Zero-Mist which might be responsible for the pitting.

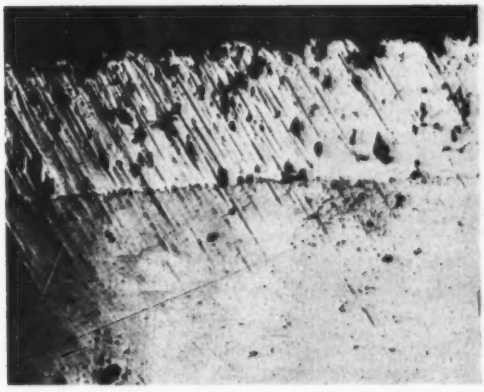


Fig. 9.—Chrome-plated coating 0.2 mm. thick obtained on F-516 steel (x 100).

(4) It is tentatively suggested that due to its nature, Zero-Mist has a stronger effect on lead anodes than the usual baths and they have a tendency to become dark. This fact has been verified, and a black residue (easily detachable) was noticed which had a different appearance from that in normal hard chrome plating solutions using pure lead or tin-lead alloys ; its analysis showed that it was mainly lead dioxide. Such sediment appears to be the cause of the formation of the small dark nodules previously described.

(5) As a result of micrographic inspection, there seem to be far more inclusions in the chromium deposits with Zero-Mist that in the usual solutions (*See Fig.* 9).

(6) In some cases pitting seems to arise rather from structural surface imperfections than from irregularities of mechanical origin and also from some of the inclusions formed in the chromium deposit (*See Fig.* 6).

(7) The use of tin-lead anodes in a projected third stage of the research, promises some interesting results.

(8) Zero-Mist seems to be suitable in certain cases and this fact has recently been confirmed by a Spanish firm which has been using it for many months in the hard chromium plating of textile components and they are satisfied because the abnormalities are being controlled more and more and do not in any way result in rejects.

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CHEAPER AND MORE EFFICIENT CLEANING OF RELAY PARTS WITH *ULTRASONICS*

TWO years of experience with Sonogen* ultrasonic equipment at the Allied Control Company (Plantsville, Conn., U.S.A.) has shown that this new method of cleaning helps to produce a more reliable product at lower cost. The company makes precision relays which occupy less than 1/4 cu. in. of space, yet they are capable of switching loads up to ½ amp. in less than one-thousandth of a second. A speck of dust between the contact faces could mean failure of the relay, resulting in malfunctioning of other vital components. Because this type of relay is used in aircraft and missiles, its reliability factor is of utmost importance. For example, it can be shown mathematically that with more than 300,000 separate parts going into one Atlas intercontinental ballistic missile, each component must have a reliability of 99.99996 per cent if the missile is to hit its target nine times out of ten.

Six model AP-25B generators, and six type T-52 tank/transducer combinations, made by Branson Ultrasonic Corp. (Stamford, Conn.) are capable of handling the plant's daily production. Contact pieces—they are of tungsten, tungsten-silver, palladium, platinum, gold or its alloys—and beryllium-copper contact arms are ultrasonically cleaned in batches. Then, after each soldering operation and again after final assembly, working sections of every relay are cleaned ultrasonically, followed by another ultrasonic rinse. Throughout the several stages of manufacture, relays are checked with electronic equipment, to ensure that their operating characteristics are within strict limits. Contact resistance may be no more than 0.05 ohm, contact bounce must be less than 250 microseconds, and operating and release time from 1/4 second to 1 millisecond, depending on the type of relay.

Relays for military applications also undergo a series of environmental tests. Among these are 30 days under 95 to 100 per cent relative humidity; shock loads up to 100 g.; temperature cycling from —65 to +200°C.; vibration at 2,000 cycles per second for nine hours at an equivalent amplitude of 20 g., both with relay energized and un-energized, and in each of three planes.



Fig. 1.—Before being broken up into some 50 individual pieces, thin strips of special alloy contacts are cleaned ultrasonically. Cavitation in the liquid, produced by the Sonogen generator and transducer, quickly removes all traces of contaminants, to yield a dependable, low-resistance contact.

Before ultrasonic equipment was installed, spray guns were used to inject vapourized solvent into the working end of each relay in the hope of cleaning

(*Continued in page* 475)

Fig. 2.—Before ultrasonic cleaning was introduced solvent was air pressure sprayed around each assembled miniature relay. Vapours were exhausted out of plant by fume hood, a loss of several hundred dollars' worth of cleaning fluid per month.



*Registered Trade Mark, Branson Ultrasonic Corp.

Cleaning with Ultrasonics

(*Continued from page 474*)

it. Not only was this method unreliable, but it was costly as well. All solvent vapours had to be exhausted and none could be reclaimed. The total cost in solvent expended was about $400 per month.



Fig. 3.—Using ultrasonic equipment, six girls can handle entire production, cleaning separate parts as well as completed relay assemblies. Contaminated solvent is distilled, can be used over to keep costs down to minimum. Only a minor fraction of the solvent is now lost through exhaust system.

The ultrasonic cleaning procedure now in effect still uses a solvent, but only minor amounts are lost due to evaporation through the fume hoods. Each Sonogen cleaning tank contains water with a wetting agent, into which two 1-pint solvent-filled beakers have been inserted. The ultrasonic energy is transmitted through the glass wall with little loss, to cause cavitation in the solvent for high-speed, uniform cleaning. Small components are immersed by means of a "tea-strainer"; completed relays are held individually in a special tong.

Immersed for 15 to 30 seconds in the first beaker, parts are then transferred to the second for rinsing, to be sure of removing all contaminants. A compressed-air jet blows off any solvent remaining on the relay coming out of the bath.

After every four lots of piece parts, or after every 25 completed relays have been cleaned, both the cleaning and rinsing beakers receive fresh solvent. Contaminated solvent is collected, distilled, and reused.

Formerly it was not uncommon for 10 per cent of the day's production to return for a second cleaning, because electrical tests showed excessive contact resistance, due to films, oxides, or dust. Rejects on this basis have now been reduced to a few per cent. Nine out of ten sent back can be corrected by ultrasonic cleaning. On the few which do not respond, microscopic examination is used to determine the reason for fautly operation.

Ultrasonic cleaning also reduces the chance of human error. When each side had to be sprayed with solvent, sometimes the second side was forgotten. This is no longer possible. Also, cleaning is faster, and above all, more consistent. Some batches cleaned by the older method prior to plating were not entirely free of soils, resulting in poor adhesion of the plating to the basis metal. Now, ultrasonic cleaning achieves uniform results, and gives the relay department head direct control over the quality of the end product.

Exhibition of Fabrication and Applications of Plastic-Coated Steel Sheet

AN exhibition devoted entirely to the fabrication and applications of Stelvetite plastic-coated steel sheet, is to be held at the Royal Festival Hall, London, from January 13 to 16, 1959, by the manufacturers, John Summers and Sons Ltd., of Shotton, Chester. The exhibition is being arranged in order to demonstrate the many potentialities of Stelvetite.

There will be a series of demonstrations including spot welding (which can be done without damage to the P.V.C. coating), high-frequency welding, lock forming, printing and drum sealing.

Stelvetite in all its available colours and gauges will be shown together with a large selection of articles now being produced in the material such as office furniture and machines, chemical equipment, refrigerators, domestic water-heaters and clocks etc.

Tickets of admission can be obtained upon application to John Summers and Sons Ltd. (M.R. & D.), St. Ermin's, Caxton Street, London, S.W.1.

Spotlight on the Plating Laboratory

(*Continued from page* 466)

Table I

Comparative Costs of Deionized and Distilled water

Water Board	Hardness ppm.	Approx out-put per cartridge (Elgalite)	Approx cost of 10 gal. deionized water	Approx cost of 10 gal. of triple distilled water
Aberdeen	17.5	80 gal.	1s. 3d.	
Aberystwyth	10	80	1s. 3d.	
Belfast	50	40	2s. 6d.	
Birmingham	20	80	1s. 3d.	
Bristol	230	8	12s. 6d.	
Cardiff	45	42	2s. 5d.	
Derby	60	32	3s. 2d.	15s. 0d.
Edinburgh	70	30	3s. 4d.	
Exeter	60	32	3s. 2d.	
Glasgow	10	80	1s. 3d.	
Leeds	53	39	2s. 7d.	
Leicester	100	20	5s. 0d.	
Liverpool	50	40	2s. 6d.	
London	259	8	12s. 6d.	16s. 8d.
Manchester	37	55	1s. 10d.	
Newcastle	108	20	5s. 0d.	
Plymouth	10	80 plus	1s. 3d.	15s. 0d.
Sheffield	48	45	2s. 3d.	
Swansea	30	75	1s. 4d.	

generation thus making for the utmost facility in operation. A good indication of the comparative costs of deionized and distilled water can be obtained from Table I[2]. From this it will be appreciated that high-grade water can be used to make up even quite large quantities of experimental and pilot-plant planting solution without excessive cost.

Another application for ion-exchange resins in the plating laboratory is for the removal of certain constituents from samples of solution to facilitate the analysis of other ingredients. A good example is the titration of boric acid in nickel solutions, where the green nickel colour tends to obscure a rather delicate colour change at the end-point. By first passing the sample through a short glass column packed with granules of Amberlite I.R.-120, a sulphonic acid base cation exchanger resin, the nickel is removed and the effluent after neutralizing to *p*H 4.0 can be titrated for boric acid without difficulty by an inexperienced laboratory assistant.

These notes, in no way exhaustive, will it is hoped serve to show that for quite a nominal outlay impressive increases in speed and reliability of plating-shop analyses are often readily obtainable. Further, the investment of a few hundred pounds on instruments can often pay big dividends by reducing the time necessary for an analysis to a few minutes even for multi-constituent solutions.

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Technical Control in Electroplating

(*Continued from page* 463)

DR. H. E. ZENTLER GORDON (Modern Electrolytic Patents and Processes Ltd.) referring to the instance quoted by Mr. Smith in his paper on the corrosion of stainless steel, said that the corrosion resistance of stainless steel depended on the presence of a continuous oxide film on the surface. He felt it was worth pointing out that when a stainless-steel component was electrolytically polished the film was rendered permanent and continuous and capable of standing up to considerable punishment during storage, provided that it was not shut off from contact with air. A similar state of affairs existed in the case of brass and was, of course, well known in aluminium.

MR. E. A. OLLARD (Atlas Plating Works Ltd.) said that he was surprised to hear Mr. Freeman say that .15 mil. of cadmium would not protect a small steel screw, and he wondered against what service conditions he considered it to be inadequate. Such screws had undergone the ordinary tropical test and it had been found that when properly plated and passivated they would undergo a normal service life of two or three years. It was impossible to deposit a thicker coating because of the build-up on the pitch diameter of the screw.

MR. D. W. SMITH replying to the points raised in discussion said that the reason for specifying an undercoating of tin or nickel when plating cadmium on brass or copper, was that service had shown on very many occasions that when cadmium was plated direct onto brass it just disappeared.

The problem of plating on screw threads was a vexed one, which was actively under discussion. He was not of the opinion that .15 mil. of cadmium gave the sort of protection that they were looking for, but using any other metal would require up to three times the thickness required by cadmium. The most effective answer would to be use undersize screws, but that of course presented serious manufacturing problems.

Mr. Ollard had mentioned that the .15 mil. coating had been shown capable of giving adequate protection for 2-3 years, but the sort of life which was sought for Service equipment was of the order of ten years.

He had been interested to learn that electrolytic polishing would thicken the oxide film on the stainless steel, but it would appear that unrestricted air flow was still necessary to maintain protection. The problem with the parts with which he was concerned was that the flow of air was restricted and he had experienced some really major corrosion, even of fully austenitic stainless steel arising from a damaged oxide film in the absence of an adequate air flow.

FINISHING NEWS REVIEW

FACTORY EQUIPMENT EXHIBITION

MORE details of next year's Factory Equipment Exhibition and its associated conference to be held at Earls Court, London, from April 7 to 17, have recently been released.

The events will cover a wide field of industry and will form a comprehensive presentation of products, services and ideas. Many stands will illustrate recent developments in factory construction, maintenance and services including heating, air conditioning and ventilation. There will be a self-contained heat and sound insulation exhibition and some hundreds of exhibits will cover various types of workshop and production equipment, measurement, instrumentation and automatic control. Sorting, feeding, finishing, handling and packaging will be well represented, say the organisers.

Good Year For Newton Jigs

MORE than 150 guests at Newton Plating Jigs and Insulations Ltd's Christmas dinner and dance held at Sheen, London, recently heard the chairman of the company refer to the firm's record trading during the past year.

ENAMELLERS IN BANBURY

Inaugural Meeting of Aluminium Section of V.E.D.C.

THE newly-formed aluminium section of the Vitreous Enamellers Development Council held its inaugural meeting recently at the Banbury works of the Northern Aluminium Co. Ltd. Eighteen directors and executives of companies engaged in various aspects of vitreous enamelling met to take the first steps towards a closer liaison between interested organizations and to " establish a firmer and more formal place in industry and commerce." One of the items discussed was a proposal by the acting chairman, Mr. K. G. Jones, urging the need to establish standards of quality as a safeguard to all.

In his address, the chairman stated that the production of a vitreous or porcelain finish on aluminium has been possible for several years now, although put to commercial use only comparatively recently.

The hard wearing and completely light fast finish obtainable promises well for applications subject to external exposure, and its ability to combine brilliantly decorative effects with durability makes it ideal for use in the building industry. Good insulating properties of the coating also suggest a variety of applications in electrical work.

During a tour of the Banbury works after the meeting, those attending showed considerable interest in laboratory specimens of vitreous enamel on aluminium that could be drilled and sawn with negligible chipping of the surface. Exposure tests also carried out indicated good resistance to spalling at cut or damaged edges.

V.E.D.C. EXPAND ENAMEL SERVICE

THE Vitreous Enamel Development Council have announced that their enamel advisory service—a free information service for housewives, merchants, and industrialists—has now been extended to the Midlands, Scotland and Wales.

The addresses and telephone numbers are as follows : **Midlands**—Cornwall Road, Smethwick, Staffs., Telephone Smethwick 1915. **Scottish**—Gowan Avenue, Falkirk, Falkirk 445. **Welsh**—Hurman Street, Cardiff, Cardiff 33644.

Seen below are many well-known personalities in the metal finishing field who attended the Banbury meeting to establish an aluminium section for the V.E.D.C. Hosts for the occasion were Northern Aluminium Ltd. who later conducted the visitors on a tour of their works.





U.S.S.R. Aluminium Export Limit

THE Soviet authorities have informed the Board of Trade that Raznoimport—the foreign trade organization which alone is empowered to sell Soviet aluminium—will not export more than 15,000 tons of unwrought aluminium to the U.K. in the next 12 months.

At the same time, the Board of Trade announce that they have decided to take no further action on the application by the Aluminium Co. of Canada Ltd. for an anti-dumping duty under the Customs Duties (Dumping and Subsidies) Act, 1957.

Leaders of the Canadian aluminium industry have several times this year spoken of the disturbing effect on the Western economy of sales of Russian aluminium.

New Technological Award

M.C.T. to be "Mark of Distinction"

BRITISH industry will benefit by a new national award to be made for research into problems related to its needs.

The National Council for Technological Awards announced last month that they have decided to create an award higher than the Diploma in Technology. Their intention is that this award shall be a mark of outstanding distinction granted to a student who has proved his ability by completing a substantial programme of work demanding the application of his knowledge to the solution of a problem of value to industry.

The Council will establish a college to be known as The College of Technologists, and the new award will take the form of membership of this College (M.C.T.).

The Council believe that to carry out successfully post-diploma work of this character, students must remain in contact with industry or with commercial laboratories.

Before starting on such a programme a student must apply to The College of Technologists, through the technical college at which he will study, to be registered as a candidate. The College will consider particularly the qualifications and experience of the student. the suitability of the programme offered and the arrangements to be made for carrying out the work both at the technical college and in industry.

The Council suggest that a three-year period of work would cover their requirements, provided it can be arranged for a high proportion of the student's time to be devoted to the programme of work proposed.

Registration of candidates will not be restricted to holders of a Diploma in Technology, but may be extended to holders of equivalent qualifications. Teachers in technical colleges will be encouraged to become candidates for the award.

CORROSION EXHIBITION

A DISPLAY of anti-corrosion methods and materials will be staged in London next April at the 1959 Corrosion Exhibition in the Royal Horticultural Society's New Hall, Westminster. For four days from April 27, 69 exhibitors will show and demonstrate new developments against corrosion. Organisers are the journal *Corrosion Technology*, and nearly 20,000 sq. ft. of floor space are to be used. Enquiries should be made from the exhibition organiser, Leonard Hill House, Eden Street, London, N.W.1.

Aluminium in Interior Decoration



Aluminium Canada House, a new 7-storey building recently completed in London's Berkeley Square, is under lease to Aluminium (Canada) Ltd. Construction was by F. G. Minter Ltd., the architects being Gunton and Gunton. Aluminium Noral 50S alloy, anodised to give a surface coating 0.001 in. thick, has been used for the windows and for all other aluminium work in the building, and was supplied by the Northern Aluminium Co. Ltd. The massive main doors have been faced with satin-anodised aluminium sheet. Aluminium (Canada) Ltd.'s own suite is seen above ; the foyer providing access to the suite is panelled in walnut, and is divided from the elevator landing by an aluminium-framed glass screen. On the far walls as seen from the lifts, a striking wrought aluminium grille carries the maple- leaf motif.

ESSO'S NEW ABINGDON LAB.

THE new Esso research laboratories near Abingdon were opened at the end of October by Lord Hailsham, Q.C., Lord President of the Council.

Built and equipped at a cost of approximately £1,000,000 the laboratories employ over 300 technologists engaged on research into the quality of petroleum products, and research aimed at discovering new products and new methods of manufacture. Largest of the company's centres in the eastern hemisphere, it is designed to serve not only the U.K. but also all other Esso companies operating in Europe and North Africa, and is one of a chain of world-wide Esso installations which together spent over £20 million last year on research.

I.S.M.E. LONDON CONFERENCE

Metal Finishers Represented at Exhibition

THE thirteenth annual general meeting of the Institute of Sheet Metal Engineering was held at the Charing Cross Hotel, London, on November 5, immediately prior to the annual conference, and was attended by some 30 members.

On the second day of the conference the morning session was devoted to three papers on various aspects of metal finishing, with Mr. A. A. B. Harvey in the chair. The papers presented and discussed were: "Automatic Polishing with particular reference to the use of Liquid Polishing Compounds," by H. Silman and R. G. Hughes (Electro-Chemical Engineering Co. Ltd.), "Processing and Painting of Sheet Metal Components," by W. Stein and E. Podmore (Joseph Lucas Ltd.) and "Production of Anodized Finishes in Automatic Plants," by A. W. Brace (Aluminium Laboratories Ltd.).

At the exhibition held at the same time as the conference, some well-known firms in the metal-finishing industry occupied stands. A brief description of these is given below.

Albright and Wilson (Mfg.) Ltd., 1, Knightsbridge Green, London, S.W.1.

Many of the new metal-finishing processes now available from the company were featured on the stand. Considerable space was given to Phosbrite 159, a solution for the chemical polishing of aluminium and its alloys, and now being widely used for such articles as domestic hardware, motor vehicle accessories, and other products requiring a high degree of polishing and brightening. Normally an excellent polish is obtained by treatment for one to six minutes but for certain purposes the time may be longer.

Exhibits in both anodized and non-anodized aluminium were displayed to show the effectiveness of the product.

Cosmetic cases in brass and gilding metal provided examples of the use of two variations of the range, Phosbrite 183 and 184.

Aluminium Development Association, 33, Grosvenor Street, London, W.1.

The exhibit showed several fields where anodized aluminium is playing an increasingly important part. The material is eminently suitable for many out-door applications requiring brightness or colour as well as durability.

Examples were shown of the use of anodized aluminium in architecture, particularly curtain walling, where it can be used for mullions, spandrels, and infill panels. Attention was drawn to the 1958 revision of B.S. 1615, specifying a new Grade A finish (anodic film 0.001-in. thick), capable of giving good service over several decades without significant loss of appearance, and to recent A.D.A. publications that have listed specification requirements, processing procedures and dyes shown by long-term exposure to be fast to light.

Also shown on the stand was the continuous anodized strip used for the production of small domestic and industrial articles. The finish can be applied to strip from 0.003-in. to 0.020-in. thickness in widths up to 12 in. The film is flexible to allow for subsequent forming.

W. Canning and Co. Ltd., Great Hampton Street, Birmingham.

In view of the importance of automation in all phases of production, the exhibit on the stand this year was devoted to automatic polishing, electroplating and anodizing.

A photograph of the recently-introduced Canning-Harper "Uniflex" automatic polishing machine illustrated the use of spray liquid polishing composition, a useful addition to automatic composition applicators for solid bar polishing.

The awkward shapes of the polished samples emphasised the versatility of the Uniflex machine and its ability to deal with items hitherto considered unsuitable for automatic polishing.

The subject of automatic anodizing was illustrated by photographs of plant supplied to the Frigidaire Division of General Motors, and samples of work from the plant were displayed. A film of this plant was shown during the Conference.

Pearson Panke Ltd., 1-3, Hale Grove Gardens, London, N.W.7.

The main part of the display on this stand was taken up with Schuler presses, but also on display were Erichsen finish testing instruments and apparatus.

Erichsen Finish Testing Instruments and Apparatus. On show was a selection from the 75 instruments comprising the range. This included a wet and dry film thickness gauge for measuring the thickness of protective films such as lacquers and paints; a magnetic film thickness gauge for measuring the thickness of protective films on a ferrous base without damaging the film; and a new Erichsen instrument for measuring mark resistance of protective films, such as enamels, etc.



The Pyrene Co. Ltd., Metal Finishing Division, Great West Road, Brentford.

The exhibit on this stand featured the company's new cold Bonderite system, and the savings in fuel possible as compared with an orthodox spray system.

To illustrate this, the company had on loan a double-track Hornby "Dublo" railway layout in operation. On the inner track, a 5-wagon train of coal trucks illustrated the amount of fuel a plant might need in a given time to operate the cold Bonderite system; on the outer track, a 16-wagon train illustrated the corresponding amount of fuel required to operate the same plant using the orthodox system.

To drive home the point, the backdrop to the stand comprised two large photographs of the system in use at Briggs motor body works. The complete absence of steam was a notable feature of the photographs that showed Bonderized work emerging from dry-off ovens for painting.

The system includes new cold alkali cleaners effective within the temperature range 60-120°F. and a new Cold "Spra-Bonderite" process. In many cases, rinses can be run cold.

The treatment converts the metallic surface into a non-metallic zinc phosphate coating which inhibits corrosion and increases the adhesion and durability of paint finishes. An increase in the life of the paint finish results from the fact that the coating provides a clean, grease-free surface which is a corrosion inhibiting base for paint, and also acts as a non-conducting bond between the paint and the base metal.

Tin Research Institute, Fraser Road, Perivale, Greenford, Mddx.

The Institute showed their newly discovered method for the electrodeposition of bright, instead of matte, tin coatings.

The key to the new bright tin plating process is the use of a special wood tar in the ordinary acid stannous sulphate bath. The bright tin deposit is free from stains, does not finger mark easily, and keeps its attractive, shiny appearance.

(*Continued in page* 482)



C.D.A. Building Chief's Tour

THE building engineer of the Copper Development Association, Dr. E. Carr, Ph.D., B.Sc., C.G.I.A., has recently completed an extensive tour of large areas of N. and S. Rhodesia, and in the Union of S. Africa.

Primary object of the visit was to investigate the use of copper for building purposes in the areas, to obtain a comprehensive appreciation of prevailing African conditions and to advise architects, local authorities, and others about the employment of the metal.

To meet the shortage of skilled labour generally prevailing throughout Africa a new type of prefabricated copper roofing has been developed by the C.D.A. building department during the last 12 months. The association says that this aroused considerable interest and was widely discussed.

Though the services available at the C.D.A. headquarters in London have always extended to all parts of the Commonwealth, it has now been decided to form an independent C.D.A. in the Central African Federation to further the use of copper and its alloys by African industries.

During his tour, Dr. Carr was able to assist on the establishment of this.

CHANGE OF NAME

WELL-KNOWN manufacturers of a wide range of automatic and hand strapping machines for packages of all types, Fredk. A. Power and Sons (Box Strapping) Ltd., Landor Street, Birmingham, 8, will in future be known as Power Strapping Systems Ltd. The change applies only to the title of the company.

TECHNICAL *and* INDUSTRIAL APPOINTMENTS

Mr. Robert Wayne Devereux has been appointed sales manager of **Warwick Production Co. Ltd.,** Birmingham Road, Warwick.

Mr. Devereux joined Warwick in 1957, after service with various other companies of the Almin Group. He is the son of the late Col. W. C. Devereux, C.B.E., founder of the Almin Group.

* * *

The British Aluminium Co. Ltd., have announced that Mr. A. W. Killeen has been appointed manager, Leeds branch office, to succeed Mr. A. E. Heeley.

* * *

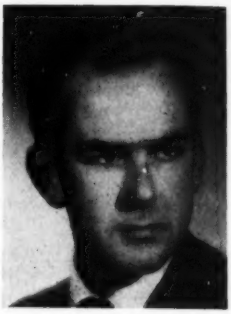
The following members of the staff have been elected to the board of directors, of **Wolf Electric Tools Ltd.,** Pioneer Works, London, W.5 : Mr. N. McCann, secretary and director. He joined the company as an accountant in 1935 and was appointed company secretary in June, 1945. Mr. R. G. J. Nisbet, director of Canadian operations. Mr. Nisbet joined the company as a sales representative for Scotland in 1935 and was appointed home sales manager in 1941. He was appointed general manager of Toronto Branch in 1952. Mr. J. A. Jackson, works director. He joined the company as works manager in February, 1943, when the factory site occupied an area of 35,000 sq. ft., a quarter its present size. Mr. W. N. Scottorn sales director. Mr. Scottorn joined the company in September, 1946, as manager of the Leeds branch and was appointed home sales manager in 1952.

* * *

Mr. David E. Burton, B.Sc. (Eng.), has been appointed to head the London technical sales department of **Rocol Ltd.,** Rocol House, Swillington, nr. Leeds, at Ibex House, Minories, E.C.3.

* * *

Mr. H. N. Wigan has resigned from the board of the **Amber Chemical Co. Ltd.**



Mr R. W. Devereaux

Mr. J. Firminger, who joined the company at the end of 1957, and was appointed general manager home sales, has been appointed technical manager.

Mr. Firminger had previously held several technical posts, mainly in the petroleum industry, having been in the Esso European laboratories and the Esso research laboratories from 1941 to 1948. Mr. Firminger has also had a number of years' experience with British and American concerns, both in producing and marketing fuel additives. Major-General E. P. Readman and Miss V. A. Pease have joined the Board of **Amber Chemical Industries Ltd.** Major-General Readman has recently retired from the post of managing director of the English Steel Tool Corpn. Miss Pease has been for some time past a director of the Amber Chemical Co. Ltd. and Charles H. Windschuegl Ltd., component companies of the Amber Group.

* * *

Mr. T. I. Williams has been appointed managing director of **Harshaw Chemicals Ltd.,** Waltham Cross, Herts, in succession to Mr. A. C. Benning who has returned to the United States. Mr. Benning retains his seat on the board of directors.

* * *

B. O. Morris Ltd., Coventry, manufacturers of "Morrisflex" equipment, have announced the following appointments : Mr. J. T. Troman has been appointed a director of the machine tool division of B. O. Morris Ltd., Portsmouth. Mr. O. G. Eves has been appointed works director of B. O. Morris Ltd., Coventry, and Mr. L. Smith has been appointed a director of Bramble Engineering Co. Ltd., Coventry.

EUROPEAN FEDERATION FOR PURCHASERS

AT a meeting in Dusseldorf recently, a European Federation of Purchasing (Federation Europeenne de l'Approvisionnement) was formed. One of the founder members is the Purchasing Officers Association in the United Kingdom, who have linked with similar organization in Germany, France, Holland and Sweden to form the Federation.

Among the objects of the Federation are the promotion of purchasing as a basic and distinct function of the management structure in trade, industry and public administration, and the provision of a body recognized as the one through which the purchasing function can be represented in international affairs.

Secretary of the international organisation is Mr J. R. Blinch, at Wardrobe Court, 146a Queen Victoria St., E.C.4.

TECHNICAL BOOKSHELF

The Measurement of Thickness. George Keinath. National Bureau of Standards, Circular 585. 1958. U.S. Government Printing Office, Washington 25, D.C. 79 pp., 50 cents.

THE publication surveys the available information on the various methods and problems of measuring thickness frequently encountered in science and industry. Measurement of physical parameters involved in the practical measurement of thickness, such as displacement, is covered, in addition to some more general aspects of the measurement, such as dynamic response. The methods are treated in seven groups, according to physical operating principles; mechanical, chemical, electrical, magnetic, optical, X-ray, and radio-active radiation.

Although the methods and instruments are not described in detail, a discussion of ranges, accuracy, advantages and limitations is included. One section discusses thickness meters for the blind. A bibliography of references, a limited list of suppliers, and a detailed index of the gauges, methods, applications and trade names covered are appended.

Zinc Dust in Paints. London: 1958. Zinc Development Association, 34 Berkeley Square, London, W.1. Gratis.

THIS booklet, a completely new version of an earlier publication, includes comprehensive information about the uses of zinc dust paints and contains many photographs of their varied applications. A list of contents and bold section headings make for easy reference.

It is intended as a general guide to the composition properties and uses of the various types of zinc dust paints, both those which are in commercial production and those which are still experimental. Much of the booklet deals with "zinc-rich" paints which have been developed during the last 20 years, mainly in Great Britain, and which are perhaps the most valuable of all paints containing zinc dust. When dry the "zinc-rich" paint film contains 92 per cent or more of metallic zinc in a special organic binder, to protect steel sacrificially in the same way as other metallic zinc coatings. "Zinc-rich" paints are thus particularly suitable for new steelwork and for the repair of damaged zinc coatings on older structures. The booklet also discusses other zinc dust paints, such as inorganic silicate paints and zinc dust/zinc oxide paints.

Corrosion of Metals by Vapours from Organic Materials. Vera E. Rance and H. G. Cole. London: 1958. H.M.S.O. for Min. of Supply, Strand, London, W.C.2. 2s. net.

THIS booklet has been published by H.M.S.O. on behalf of the corrosion and electrodeposition committee of the Inter-Service Metallurgical Research Council (Admiralty and Ministry of Supply).

Over many years, instances have been observed of the corrosion of metals in restricted spaces by reactive organic vapours, such as those that may be evolved from woods, glues, paints, varnishes and plastics, though comparatively little has been published on the subject.

A survey has been made of instances of metallic corrosion in service or under laboratory conditions, classified according to the source of vapour. This information, the discussion and conclusions will be of interest to all concerned with the reduction of losses due to corrosion, and particularly to those concerned with the packaging or storage of metal components or with enclosed electrical equipment.



Midland I.M.F. Xmas Party

THE traditional stag party of the Institute of Metal Finishing's Midland branch will this year take the form of a "Christmas Depositors' Do" at which special entertainment and attractions will be provided. To be held at the White Horse Hotel, Congreve Street, Birmingham on Thursday, December 18, dinner will be served at 7.30 p.m. with a rendezvous in the grill room bar from 6 p.m. onwards.

A.D.'s London Office

MANUFACTURERS of AD Taccy rags, Taccy pads and the "Barrier" method of dust control, Anti-Dust Services Ltd., of Dudley, Worcs., have opened an office in London to serve south-east England. The office is under the control of Mr. A. A. Evans, sales manager of the London and S.E. area, and is at 27 Eastern Avenue, Wanstead, E.11. Telephone: Wanstead 3467. The company can now offer in this area a rapid and personal service for the control and elimination of dust in industrial processes.

PRIVATE EXHIBITION OF P.V.C. CHEMICAL PLANT

A private exhibition of non-corrodible chemical plant design and construction was held recently at the Grand Hotel, Birmingham, and the Black Boy Hotel, Nottingham, by Extrudex Ltd., Bracknell, Berks., to feature their "Hipact" and "Norpact" materials.

"Hipact," made from p.v.c., is an impact resistant, non-corrodible material used for chemical and petroleum piping, based upon Geon R.A. 170 (high-impact) manufactured by British Geon Ltd. "Norpact" is unplasticised p.v.c. for chemical plant fabrication.

The exhibition showed a fume extraction system designed for a small plating shop. Fumes were extracted from two tanks, one in polyester/glass and the second in Norpact p.v.c. Two methods of extraction were illustrated: lip extraction and an over-all canopy hood, both leading to ductwork fabricated in Norpact through which the fumes passed into a small scrubbing tower, made entirely of unplasticised p.v.c. and packed with p.v.c. rasching rings.

A fan, also of Norpact, was installed at the head of the tower to draw the fumes up through the packing over which water was sprayed continuously. Finally before passing to atmosphere, the fumes were condensed over an eliminator box containing p.v.c. baffle plates.

In addition to this display illustrating in small size some of the applications of p.v.c. to chemical plant fabrication, there was a demonstration of the full range of tubes and fittings in Norpact and Hipact p.v.c., now available from stock in Birmingham and from Bracknell. The company says that further private exhibitions of this type will be arranged from time to time, in other parts of the country, so that as many as possible will be able to see the range.



Polished Joints

DIESEL-HYDRAULIC locomotives being made for British Railways have a cab built up of some 30 separate castings bolted together.

One firm making these cabs, Lightalloys Ltd., Willesden, London, are giving the outside edge of each joint a vee preparation, then filling in with a ¼-in. deep sealing run using an argonarc Mark II welding torch supplied by British Oxygen Gases Ltd.

The sealing run is afterwards ground and polished. As well as keeping out the weather, it provides a smooth finish and adds strength to the joint. The filler rod is ⅛-in. "Silotectic."

I.S.M.E. Exhibition

(*Continued from page* 479)

It solders well even after storage. Samples of articles that had been treated with the process included a radio chassis, and various items of domestic wirework, all in a bright "as new" condition. Similar articles that had been left unplated had been affected by corrosion to varying degrees.

The Walterisation Co. Ltd., Purley Way, Croydon, Surrey.

Examples of phosphating processes in the sheet metal industry were shown. These included a "Red Spot" fuseboard manufactured by the English Electric Co. Ltd. "Walterised" in their plant before finishing.

Corner pieces in 24-gauge mild steel for cardboard fruit storage containers manufactured by B.K. Engineering Co. Ltd., London, had been rustproofed by a Walterisation process to permit their use in this application. Unlike the familiar triangular wooden corner pieces normally regarded as expendable, the metal products can be used over and over again.

Literature was available to describe the various Walterisation processes such as Foscote, Deran, Walterisation "E," "L," "C.I" and "M.C.," and two large microphotographs were displayed to illustrate the fine structure and close packing of the crystals in the "Fasbond" and "C.I." coatings.

PHYSICAL SOCIETY EXHIBITION

Four-Day Meeting at Horticultural Hall

AN exhibition will be held by The Physical Society at the Royal Horticultural Society's old and new halls, Westminster, London, S.W.1, from January 19-22.

The opening ceremony will be performed in the new hall by Sir Cyril Hinshelwood, F.R.S. Evening demonstration lectures will be given at 5.45 p.m. on the first three days. These will be "The physics of controlled thermonuclear fusion," by Mr. R. S. Pease (A.E.R.E., Harwell); "Frontiers of Space," by Dr. Robert Page, (U.S. Naval Research Laboratory Washington); and "Physical Science in the trans-Antarctic Expedition," by Mr. J. G. D. Pratt, introduced by Sir Vivian E. Fuchs.

BRITISH PAVILION AT IDEAL HOME EXHBN.

THE British pavilion at the recent Brussels international exhibition is to be brought to London and shown throughout the four weeks run of the Daily Mail Ideal Home Exhibition opening at Olympia on March 3.

Many thousands of people will have an opportunity of seeing the pavilion, including the hall of Tradition, the Hall of Science and Technology and the Courtyard of Invention.

Transport of the pavilion from Brussels to London will be a major feat. It belongs to the Government and when the Ideal Home Exhibition ends it will be returned to the Central Office of Information.

The entire cost of dismantling the display and bringing it to London will be borne by the exhibition organisers, the *Daily Mail*, who are to ship the two halls with their unusual shapes as deck cargo.

ANGLO-U.S. FIRMS' INSTRUMENTS LINK-UP

THE Solartron Electronic Group Ltd., Thames Ditton, Surrey, have concluded selling and manufacturing licensing agreements for the "Kintel" range of electronic products of Cohu Electronics Inc., of San Diego, California, U.S.A. The agreements are for universal rights with the exception of Sweden, and North and South America.

The range of products includes digital voltmeter systems, data amplifiers, electronic galvonometers, vibration and sound pressure measurement equipment, and many other instruments.

SIR MILES THOMAS AT EXECUTIVES EXHIBITION

WHEN Sir Miles Thomas (centre) visited the Tack Organization stand at the Directors' and Executives' Exhibition held in London recently, he was told by Tack's Mr. Peter Rendell (left) that the company is now the largest personal sales training establishment in the world. Proud boast for a firm that began only 25 years ago, and welcome news for a country that earns its living by selling abroad! In the time since the organization was inaugurated by George and Alfred Tack, more than 2,000 firms have sent employees to the salesmanship courses. Seen below with Sir Miles and Mr. Rendell is Mr. John Wheatley, the exhibition organizer.



Industrial Film Festival

Entries Invited for Harrogate Show

Film entries for the second industrial film festival to be held at Harrogate from April 21-24, are invited from sponsors and all producers concerned with films for industrial or business purposes.

Those interested are asked to apply to the secretary at 3, Portman Chambers, 7/9 Baker Street, London, W.1. (Telephone No. Welbeck 1104).



O.C.C.A. VISIT SHOTTON WORKS

A DELEGATION from the Manchester Section of the Oil and Colour Chemists' Association, led by their chairman, Mr. A. W. Ayres, recently spent a day inspecting modern methods of iron and steel production at the John Summers and Sons' steelworks at Shotton, Chester

The party of thirty-six, in addition to seeing the manufacture of hot rolled and cold reduced sheets, saw the various processes through which the sheets pass for electro-zinc coating and continuous galvanising in the production of "Zintec" and "Galvatite."

The delegates were entertained to lunch by Mr. Salter, director and sales manager, and Mr. Timothy Summers, son of the company chairman.

MIDLAND SILICONES MOVE OFFICE

AFTER five years in Upper Brook Street, the London head offices of Midland Silicones Ltd. opened recently in new and more spacious premises at 68, Knightsbridge, London, S.W.1.

The company is a member of the Albright and Wilson Group and a U.K. associate of the American Dow Corning Corpn. In the twelve years that Midland Silicones has been in business, it has grown from a small sales agency for the then-novel American imported silicones to its present size, now operating what is believed to be the largest silicone-producing plant outside the U.S.

Head office departments involved in the move include home sales, export sales, rubber sales, electrical and resin sales, fluid sales, water repellent sales, supply, publicity and information departments. The M.S. south-eastern area sales office is also to move. Sales accounts will continue to be handled from the Midland Silicones plant at Barry, South Wales.

Telephone Number of the new London office is Knightsbridge 7801. The company's telegraphic address has changed to Midsil, Wesphone, London.

MEETINGS OF THE MONTH

December 16

Institute of Metal Finishing (South West Branch). "Metal Cleaning," by J. E. Entwhistle, at Grand Hotel, Bristol. 6.30 p.m.

Sheffield Metallurgical Association (Joint Lecture with Institute of Metallurgists). "Imperfections in Metals," by Prof. N. F. Mott (University of Cambridge), at Engineering Lecture Theatre, St. George's Square, Sheffield, 7 p.m.

December 17

Incorporated Plant Engineers (Kent Branch). "Treatment of Trade Effluents and Methods of Purification," by T. Waldmeyer (Reed Paper Group) at Kings Head Hotel, Rochester. 7 p.m.

Institute of Metal Finishing (Organic Finishing Group.) "Polyester Finishes: Have they a Future?" by B. M. Letsky, at the Exchange and Engineering Centre, Stephenson Place, Birmingham 2. 6.30 p.m.

December 19

Institute of Metal Finishing (Sheffield and N.E. Branch). "Automation in the Electro-Plating Industry," a film by Silvercrown Ltd. with commentary at Grand Hotel (Cavendish Room), Sheffield. 7 p.m.

Society of Chemical Industry (Corrosion Group). "Modern Views of Electrochemical Processes. (1) Cathodic Processes, (2) Anodic Processes," by E. C. Potter and T. P. Hoar, at the Society's premises, 14 Belgrave Square, London, S.W.1. 2.30 p.m. and 5.30 p.m.

January 6

Institute of Metal Finishing (Midland Branch). "Cyanide Plating Solutions." by J. M. Sprague, at James Watt Institute, Great Charles Street, Birmingham. 6.30 p.m.

January 7

Incorporated Plant Engineers (Leicester Branch). "Application of Thermostatic Controls," by J. S. Smith (The Rheostatic Co. Ltd.), at Bell Hotel, Leicester. 7 p.m.

January 8

Birmingham Paint, Varnish and Lacquer Club. Annual General Meeting, at Imperial Hotel, Temple Street, Birmingham. 7.50 p.m.

January 13

Institute of Metals (S. Wales Local Section). "The Zinc Blast Furnace," by S. W. K. Morgan, at the University College, Singleton Park, Swansea. 6.30 p.m.

Society of Chemical Industry (Chemical Engineering Group). "An Organization for Inspection," by E. W. Greensmith, at the Society's premises, 14 Belgrave Square, London, S.W.1. 6 p.m.

January 14

Incorporated Plant Engineers (Dundee Branch). "Paints and Anti-Corrosives," by R. A. Sim, at Taypark Hotel, West Ferry. 7.30 p.m.

January 14

Institute of Metal Finishing (Organic Finishing Group). "Recent Developments in Paint Applications," "Curtain Coating," by F. W. Summerland. "Electrostatic Hand Spraying," by R. Tilney, at Management House, 80 Fetter Lane, London, E.C.4. 6.30 p.m.

January 16

Society of Chemical Industry (Corrosion Group). (Joint Meeting with Glasgow Section and R.I.C.). "Protection of Motor Vehicles from Corrosion," by S. G. Clarke, at the Royal College of Science and Technology, Glasgow. 7.15 p.m.

Oil and Colour Chemists' Association (Midlands Section). "Cold-curing Amino Resins," by C. H. Morris, at Regent House, St. Philip's Place, Birmingham. 6.30.

January 19

Institute of Vitreous Enamellers (Midland Branch). "Recent Enamelling Development," by J. Semple, at Exchange and Engineering Centre, Stephenson Place.



TRADE and TECHNICAL PUBLICATIONS

NEW COMPANIES

"Ltd" is understood, also "Private Co."
Figures = Capital, Names = Directors, all unless otherwise indicated.

Royce Products (Romford), 2/W Artillery Mansions, 75, Victoria St., London, S.W.1. October 21. £2,100. To carry on bus. of manufacturers of industrial polishing mops, engineers, etc. Laurence J. Foley, Henry M. Saunders, Pamela Nichols.

Loughborough Oven Works. October 23. £100. To carry on bus. of manufacturers of gas ovens and other appliances fired by or burning gas, etc. Mrs. Pamela P. Essex, Wm. R. Message.

Arundel Painting Contractors. October 24. £10,000. To acquire the good will of the bus. of painting contractors and the like carried on as "Arundel Painting Contractors and Company," by J. Arundel and S. S. Styles at Cornmarket, Louth, etc. Sidney S. Styles, Joseph Arundel.

Giffex, 56, Albert Street, St. Albans. October 27. £500. To carry on bus. of manufacturers and sale of a product called Giffex; manufacturers of and dealers in chemicals, paints, colours, varnishes, etc. George A. Carter, Dennis C. Hurley.

Hartshead Plating Co., 14, Thomas Street, Sheffield, 3. October 27. £1,000. To carry on bus. of cutlers, electro platers, etc. Ronald Wood, Wilfred Wood.

Chesterfield Industrial Painters, Midland Bank Chambers, Gluman Gate, Chesterfield. October 28. £2,000. Eugene Kelly, Joseph Kelly, James H. Riley and Evelyn V. H. Rees.

Liver Plating Co., 4A B2 Newstet Road, Kirby Trading Estate, Liverpool. October 28. £5,000. To carry on bus. of electrodeposition of all metals, etc. Philip G. Fielding and Dorothy Fielding.

Underbody Protective Coatings, 58, Grove Street, Sheffield, 3. October 29. £500. To carry on bus. of protective platers, etc. Norman E. Brown, Philip W. Kirk.

Church Bros., White Hart Yard, Guildford Street, Chertsey, Surrey. October 30. £6,000. To carry on bus. of electro, chromium, silver, and nickel platers, etc. Mrs. Mabel A. Church, Graham E. Church.

Unity Plating Co., 243, Manchester Road, Oldham. October 30. £500. To carry on bus. of platers in all metals, etc. Frank Wilson, Eileen J. Creed.

W. & D. Electro-Plating Co., 29, Heathfield Road, W.3. October 30. £1,000. Charles J. Wilbraham, Thomas Hinde.

Disco (Richmond), 4, Berners Street, London, W.1. November 6. £1,000. To carry on bus. of wholesalers, retailers, manufacturers of and dealers in electric, wireless, magnetic, galvanic, mechanical and scientific apparatus, etc. Edward M. Tatton and Lily E. Tatton.

R. & R. Plating Products Ltd., 156, Strand, London, W.C.2. November 6. £100. David N. Rees, Geoffrey G. Rollings.

Metal Protection Products, Eagle House, Jermyn Street, London, S.W.1. November 10. £10,000. To acquire from Howard T. Stillwell an assignment of an agreement dated June 10, 1958, with Wynn's Friction Proofing International, S.A., relating to the distribution in England, Scotland, Wales and Ireland of the products of the Wynn Oil Company of California, U.S.A. etc. Reginald L. Wells, Howard T. Stillwell.

C. and E. Plating Co. (Hockley), 10B Erskine Street, Vauxhall, Birmingham, 7. November 10. £2,500. To carry on bus. of electro, nickel and chromium platers, etc. Charles W. Willock, and Mrs. E. Willock.

From the Register compiled by Jordan & Sons Ltd, 16 Chancery Lane, London, W.C.2.

A new catalogue describing their recently introduced "Class F.E." range of horizontal, double-acting balanced-opposed compressors, has been produced by The Consolidated Pneumatic Tool Co. 232, Dawes Road, London, S.W. 6.

The 12-page brochure gives full details of design, application and operation, together with detailed specifications of operating examples. Component parts are illustrated in detail and a wide use has been made of both illustrations and line diagrams in a clear, attractive layout.

After an introduction dealing with considerations of design involved in eliminating vibration, constructional details are given of the frame, crankshaft connecting rods, cross-heads, bearings, cylinders and pistons, lubrication, intercoolers and automatic control. This section is followed by specifications of various units ranging in capacity up to 5,000 cu. ft. per min. and pressures up to 3,000lb. per sq. in. Free on application.

* * *

"The discovery of new chemicals and their development into industrial products depends ultimately on the quality of the industry's scientists and technologists and the facilities available to them. The industry offers chemistry and chemical engineering graduates exceptional opportunities . . . and a challenge, for all who wish to enter must be prepared to work in an atmosphere of constant change and development."

This paragraph appears in the introduction to a new illustrated booklet, published recently by Albright and Wilson, Oldbury, Birmingham, addressed to recently-qualified chemists and chemical engineers seeking a career in industry. The middle sections of the booklet describe three of the largest manufacturing companies in the A. and W. Group—Albright and Wilson (Mfg.) Ltd., Midland Silicones Ltd. and Marchon Products Ltd.—and the opportunities they offer to science graduates. The scope of the technical and other departments of each company and the sort of work a graduate will undertake on appointment are described. Other sections include notes on further education and training schemes operated by the Group, and conditions of employment. Copies are obtained from the company's staff offices.

* * *

A new paint for the protection of galvanized surfaces is described in *Red Lead Technical Letter No.* 13 recently issued by the Lead Industries Association, 60 East 42nd Street, New York 17, N.Y. The paint has a red lead: iron oxide: zinc dust pigmentation in an alkyd resin vehicle and has undergone six years of exposure testing. It can be used on rusted, weathered or treated new galvanized surfaces, providing a single paint for all of these conditions. It may be used as a primer in one or more coats, either exposed to the weather or covered with a suitable finish coat. Information regarding surface preparation is also included.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Tube-Cleaning Equipment

IN recent months, Vacu-Blast Ltd., Bath Road, Slough, Bucks, have developed and patented equipment and a technique for cleaning the internal surfaces of tubes and piping. It is claimed that a small range of simple attachments enables the cleaning of practically any shape or size of tube from $\frac{1}{8}$ in. bore upwards.

The essential part of the equipment is the Vacu-Blast machine itself. Incorporating a pressure-vacuum system for abrasive feed and recovery with a thorough segregation of grit, slag and dust, the system lends itself to adaptation for tube cleaning (Fig. 1).

In effect, the tube is used to replace the Vacu-Blast gun with the pressure and vacuum hoses connected at opposite ends, the closed circuit being maintained within the tube body. According to the various sizes of tube, different methods are employed. With tubes of $\frac{1}{8}$ in. bore the blow-through method is used but the cross-sectional area of the subject items must be greater than the area of the blast nozzle. Usually a nozzle of $\frac{3}{16}$ in. bore is used and to conform with the above stated requirements, tubes of $\frac{1}{8}$ in. bore are nested to give a cross-sectional area upward of 0.077 sq. in. or seven $\frac{1}{8}$ in. bore tubes. A simple adaptor is made to nest these tubes and the Vacu-Blast nozzle is offered to the adaptor acting as a distribution box for the abrasive. In this way, back pressure is avoided and the blast stream continues throughout the length of each tube.

Tubes in the range of bore sizes $\frac{1}{2}$ in. - 2 in. can also be cleaned on the blow-through principle with the nozzle offered direct to the mouth of the tube. Above this size, the nozzle can be entered into the tube and traversed along the internal work surface.

For use with larger bore tubes three different attachments are available including a nozzle that directs abrasive at 90 deg. to the longitudinal axis of the blast hose, thereby securing impingement of the abrasive normal to the work surface. Such treatment is frequently necessary at the inner bend of tubes.

To facilitate passage of the blast hose in tubes above 8-in. bore a spider attachment to centralise the nozzle in the tube is available.

Although the method has only recently been introduced, it has been well tried and, since its initial development, machines have been supplied to a variety of industries to provide a simple method for cleaning pipes and tubing down to virgin metal ; the principal exception is where the pipe might contain a thick oily or glutinous substance able to absorb the impact of the abrasive.

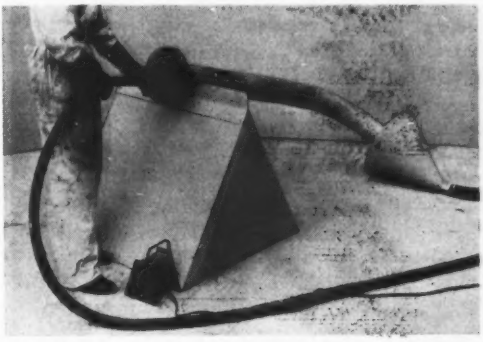


Fig. 1.—This tube-cleaning equipment uses the pressure-vacuum system of the standard Vacu-Blast machine.

In addition to the attachments mentioned above, another piece of equipment has been developed for cleaning large-bore straight tubes. Known as the rotary head it comprises two rotating blast nozzles driven by an air motor. The assembly is mounted on a carriage and is drawn through the tube while blasting is in progress. This particular item is well suited to the cleaning of straight tubes in the range 10-24 in.

Double-sided Adhesive Tapes

A NEW adhesive tape having adhesive on both sides has been announced by Evode Ltd. Stafford. The tape has innumerable uses and is expected to simplify and cheapen thousands of operations in many industries. Called " Twinstik ", the tape consists of a thin tissue impregnated with a pressure-sensitive adhesive and protected with a treated paper. It is available in a variety of widths up to 12 in. and can be applied to most surfaces to provide a strong durable bond.

The method of applying " Twinstick " is simple. The tape is unrolled and applied by hand to a surface and an outer paper cover is then peeled off to expose a second adhesive surface.

The makers say that the absence of solvents in the Twinstik adhesive surfaces makes the tape suitable for use on cellulosed and other surfaces.

Kit for Water Treatment Control

NEW and simple testing kit has been produced by Albright and Wilson, (Mfg.) Ltd., 1 Knightsbridge Green, London, S.W.1., that enables control tests to be made easily and quickly on different types of water. The results obtained using the kit are adequate for the great majority of water treatment control purposes, say the makers, although slightly less accurate than those obtainable under closely controlled laboratory conditions.

The kit can be used for the control of water treatment for steam boilers, including those where phosphate conditioning is employed, as well as for checking water softener efficiency and testing water in re-circulated cooling water systems.

Raw and softened waters can be tested for total hardness, alkalinity to phenolphthalein and methyl orange, and chloride concentration. Boiler water tests include total and caustic alkalinity, chloride and phosphate concentrations.

Phosphate conditioning to prevent scale in boilers depends for its success on the maintenance of an adequate caustic alkalinity and reserve of phosphate in the boiler water. Such conditioning is being increasingly used at low pressures, and is indispensable at high pressure. With the kit, boiler water testing can be carried out regularly and efficiently by boiler house personnel.

In an attractive lightweight transparent plastic case, the kit includes all necessary apparatus, together with polythene bottles containing reagents, and is supplied complete with an initial supply of reagents.

Further information about the kit and advice on water treatment problems can be obtained from Albright and Wilson (Mfg.) Ltd.

Low-voltage Transformer Plug

A NEW transformer plug has been designed to give added safety to operatives working with long-lead electrical appliances. Robustly constructed and cased in hard oil-resisting rubber, it is little larger than an ordinary plug, and is plugged in to a 3-pin socket, direct to the existing mains supply, to step down current from 240 v. to 25.

Called the Dohm " Electran " transformer plug, it is being marketed by the Dohm Group of Companies, 167, Victoria Street, London, S.W.1.

A hazard in industry is the use of trailing cable with portable electrical appliances. Previously-used safety measures have been either the installation of a costly low voltage wiring system, or the use of transformer units, where the lead between the transformer unit and the power point often remains dangerous. The transformer plug gives safety and mobility at low cost.



Fig. 3—An air-circulated oven

Redesigned Box Oven

SEEN in Fig. 3 is a redesigned box oven recently introduced amongst their standard range of ovens by A. E. Griffiths (Smethwick) Ltd., Booth Street, Handsworth, Birmingham, 21.

The air circulated oven has a clean external appearance combined with improved thermal efficiency. It is arranged for tray or suspension loading and can be used for trolley loading without the need for excavations. Heating can be arranged either for gas or electricity as desired. The clear entry to the oven can be seen in the illustration.

Mobile Metal Spraying Equipment

A STURDY portable metallizing truck has been developed by Metallizing Equipment Co. Ltd., Chobham, Woking, Surrey. Designed to give maximum mobility and efficiency to a metallizing installation, it eliminates time wasted searching for accessories " borrowed " for other purposes. A built-in wire rack accommodates several coils of metal spraying wires.

The metallizing wire in use is fed from a standard wire reel table, through a straightening device, at a convenient height. Shelves are provided for spare tools and necessary equipment. The rigid chassis is mounted on four wide-tread, rubber-tyred wheels, to permit easy movement with manoeuvrability. The cylinders of gas and oxygen are carried within the wheelbase, adding stability to the truck. In its operational condition, with standard metallizing accessories permanently attached, the dimensions of the metallizing truck are 2 ft. 6 in. wide x 4 ft. 6 in. long.

(*Continued in page* 488)

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(*Continued from page* 486)

Short Vacuum Metallizing Cycles

THE problem of humidity in devising efficient vacuum coating operations, has now been solved, says the F. J. Stokes Corpn., Philadelphia, Pa., U.S.A., manufacturers of vacuum metallizing equipment.

A new series of mechanically refrigerated moisture traps has been introduced by the company's vacuum equipment division for use with its own and other makes of vacuum metallizing equipment. Compact in size, the units are a result of recent developments in refrigeration engineering, and produce sufficiently-low temperatures to condense atmospheric water vapour to ice during the operational phase most affected — the fine pumping portion of the coating cycle.

The presence of moisture in the atmosphere is an especially acute problem during the late spring and summer months in the United States, leading to excessively long pump-down cycles. Units which in dry weather will regularly operate on 15 minute cycles, for example, may require as much as 30 minutes and more to pump down to the necessary 0.5 micron level during humid weather.

These extended cycles have presented a serious problem to those concerned with the efficiency of vacuum coating operations. The difficulty arises from the extra pumping load which water vapour imposes on the diffusion pumping system. The moisture — present on the interior surface of the vacuum chamber, on the pieces to be coated, and on the work-holding fixtures — can best be handled by condensing the water vapour to ice before it reaches the diffusion pumping system.

Mechanically refrigerated moisture traps provide a simple and inexpensive way of removing the water vapour from the system and shortening the pump-down time. The Stokes moisture trap consists of a cooling coil for each diffusion pump. Each cooling coil is incorporated in an adapter flange installed between the diffusion pump and the high vacuum valve. A compact, low temperature compressor supplies refrigerant to the coil to maintain its surface temperature at —115°F. or lower, low enough to keep moisture trapped as ice down to filament "flashing" pressures.

By installing the cooling coils in the high-vacuum portion of the system, between the high-vacuum valves and the diffusion pumps, the coils will never be exposed to atmospheric or roughing pressures — where they are not needed — and ice build-up will thus be minimized.

And in this position the cooling coil cannot be affected by radiated heat from the tungsten filaments used to produce the metal-vapour for coating.

Ice can be removed from the coil quickly by re-cycling hot gas from the compressor through the coil. The water thus removed passes through the hot diffusion pump in vapour form and ends up in the mechanical pump, as in conventional operation. The high limiting fore-pressure tolerances of the Stokes "Ring-Jet" booster pump, however, permits continuing pumping efficiency.

Smoke Density Indicator

A SIMPLE smoke density indicator has been developed by the Fuel Research Station of the Department of Scientific and Industrial Research. It consists of a glowing element (the "Glowring"), placed in the side flue. The element is viewed through a column of flue gas from an observation window in the front wall of the flue.

The brightness of the element can be adjusted so that it is obscured when the smoke density corresponds with No. 2 shade on the Ringelmann chart. This is the density which, under the Clean Air Act, must not be exceeded.

The Glowring has the advantage that, except for the observation window, which is easily accessible, there are no mirrors or glasses to be cleaned. The glowing element is self-cleaning, any deposits on the element being burnt off.

For installation, no extras are required. All the user has to provide is a small hole (6 in. by 5 in.) in the front wall of the flue and a single-phase electricity supply, and the price makes it economical to fit an indicator to every boiler in an installation.

The indicator is being marketed by the Shandon Scientific Co. Ltd., 6, Cromwell Place, London, S.W.7.

Bright Tin Plating Process

AN important constituent of the bright tin plating process recently developed by the Tin Research Institute is a brightener made from wood tar by a special process. A revivifying agent has also been developed for addition to an old bath when a decline takes place in the brightness of the deposits produced.

The brightener and revivifying agent are being manufactured by Shirley Aldred and Co. Ltd., and are available in England and Wales from Sonic Engineering and Equipment Ltd., 120-130, Parchmore Road, Thornton Heath, Surrey, under the name of "Brytin." A full technical service is also provided.

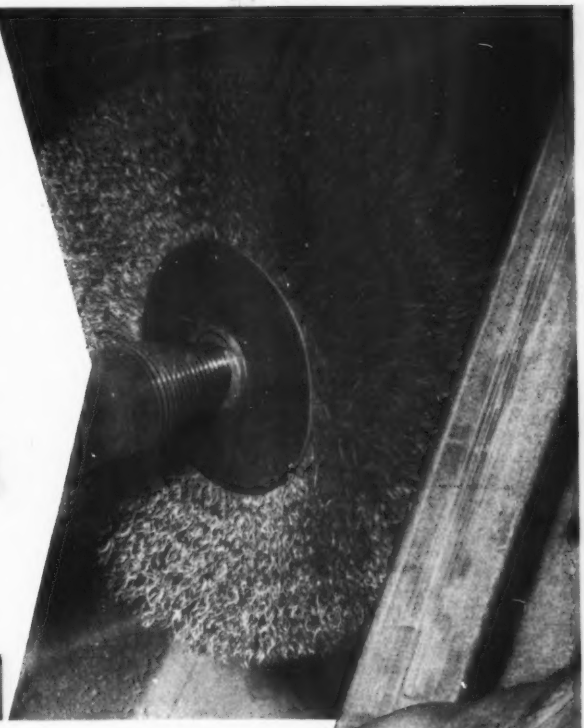
The Brytin bright tin plating process has a very wide field of application, particularly for parts that are to be soldered. One of its main advantages is that the bright coating is not perceptibly marked with the fingers.

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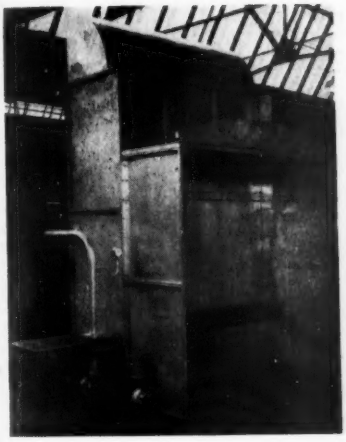
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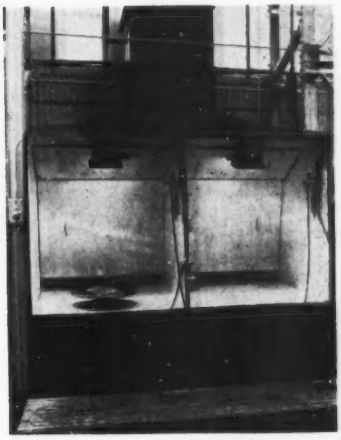
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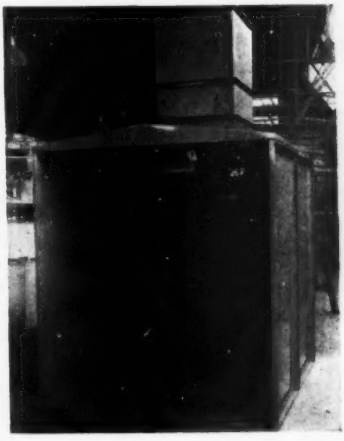
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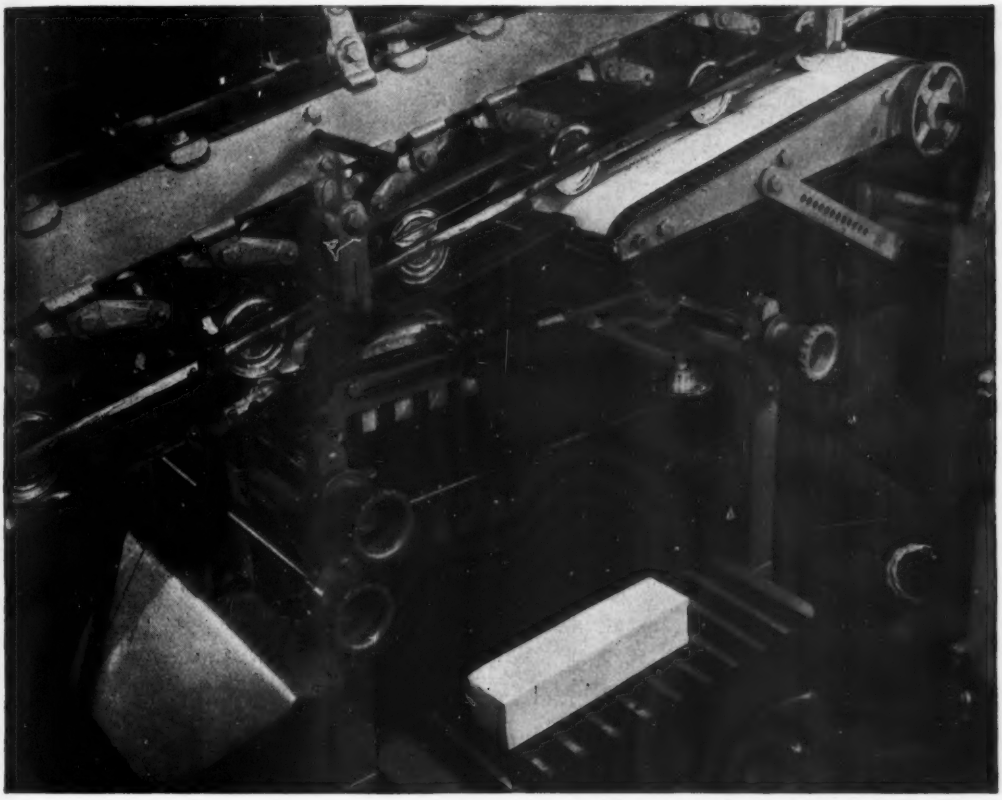


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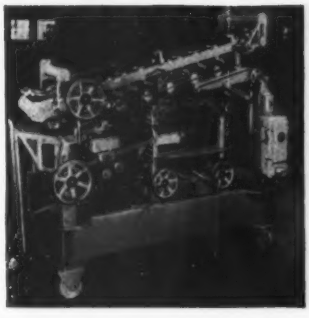


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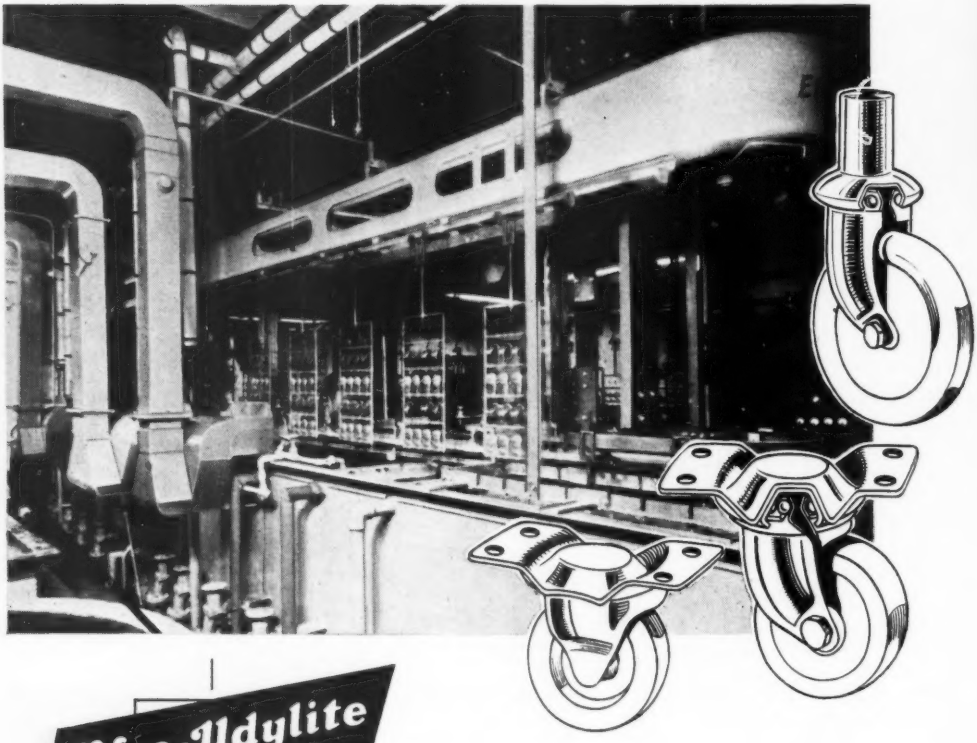
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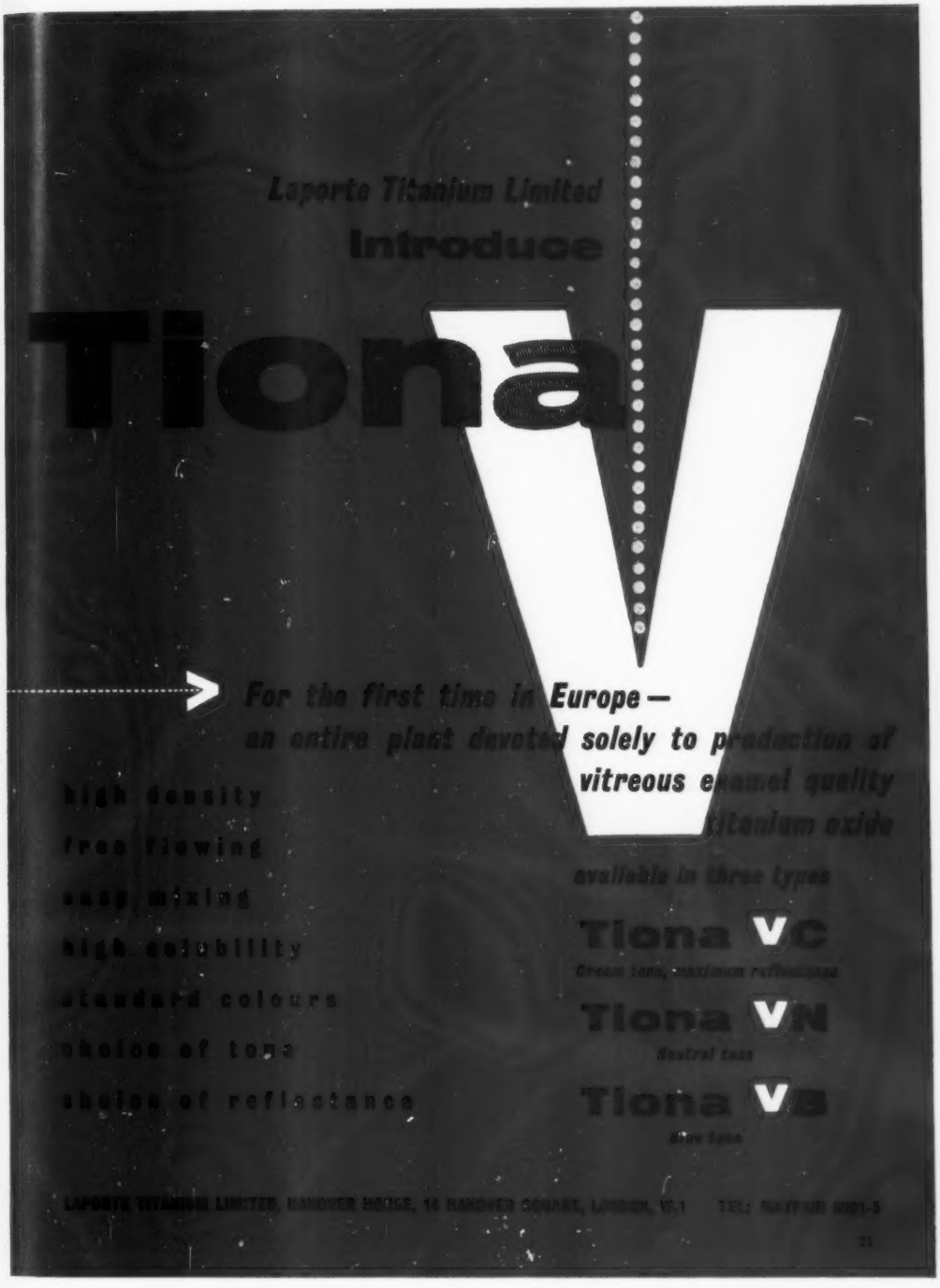
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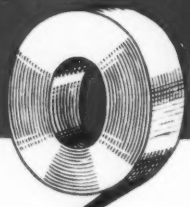
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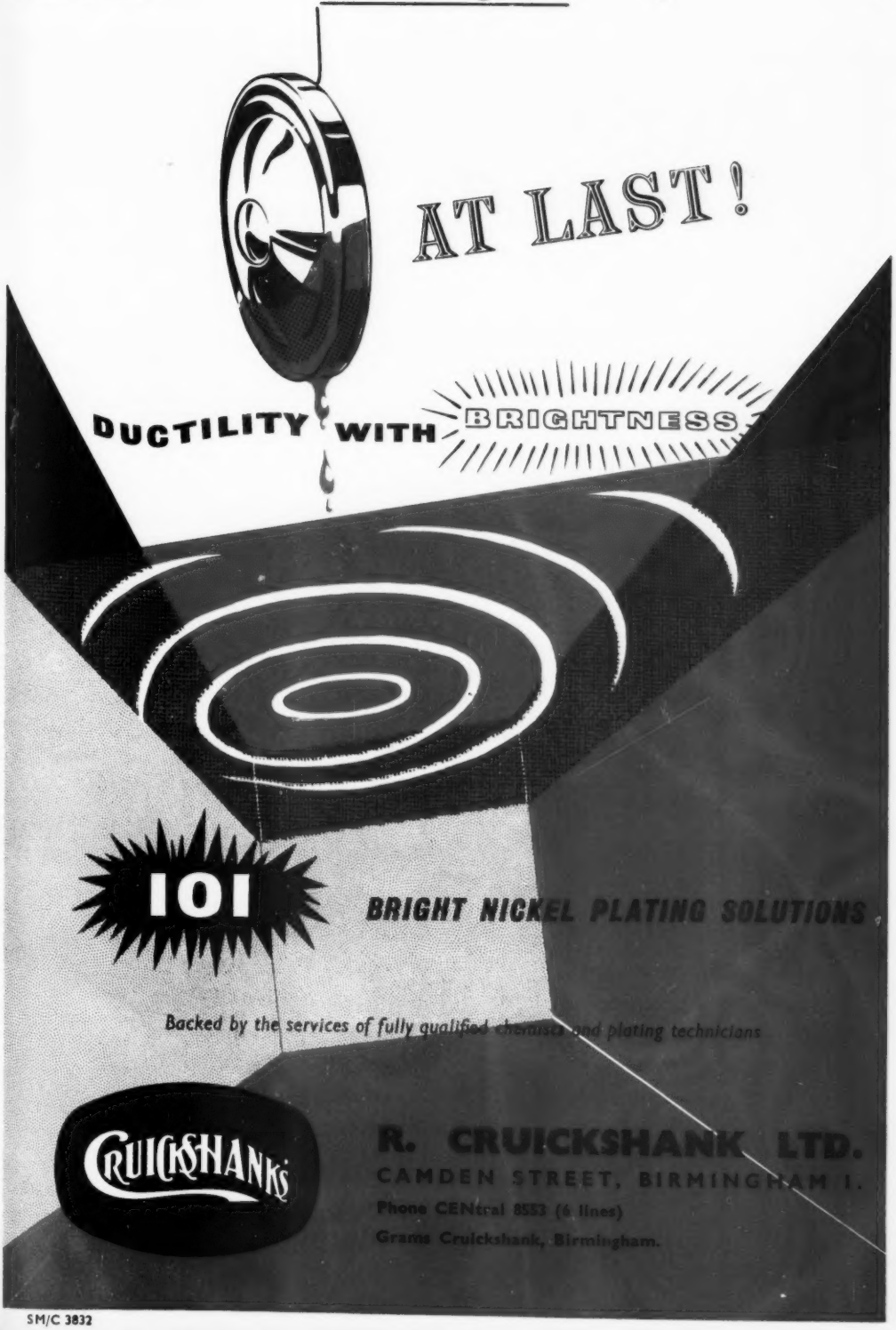
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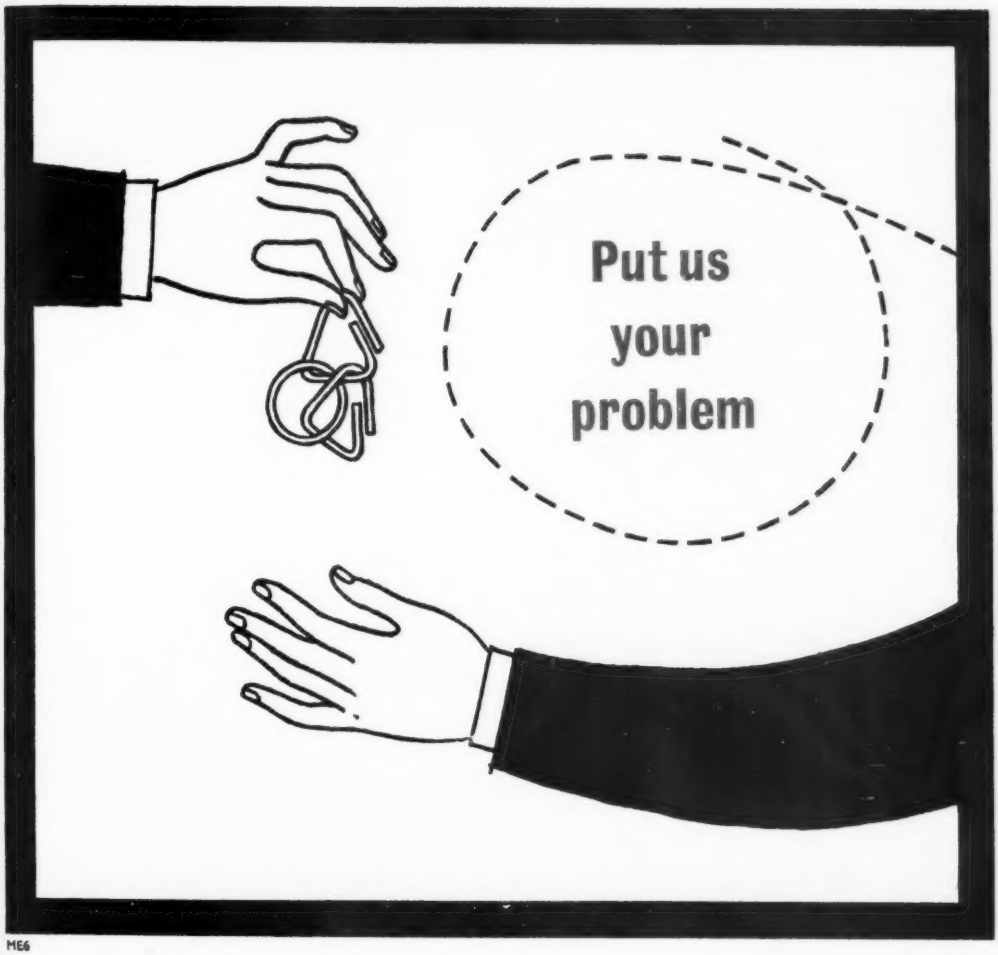


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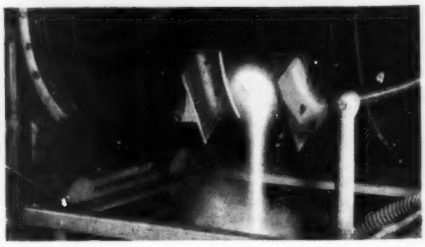


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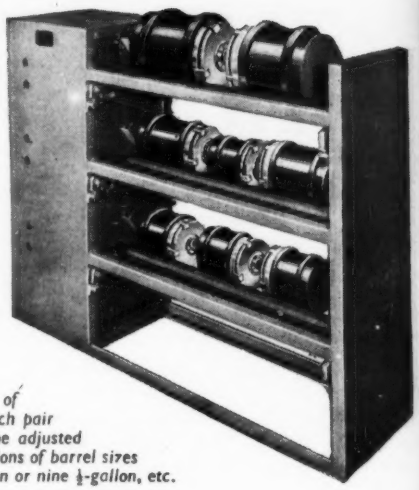
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